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THE WOLVERINE.

By WALTER FRY, In Charge, Nature Guide Service, Sequoia National Park.

The Sierra Nevada wolverine (*Gulo luscus*), is making his last stand. The animal is found in the high sierra between 6500 and 13,000 feet and is making a losing fight. Man is an enemy who seeks to kill the wolverine at every opportunity; while the porcupine, when captured as food by the wolverine, proves a fatal meal, his sharp quills puncturing the wolverine's intestines and causing painful death within from seven to ten days.

Range of the Wolverine.

Wolverine formerly ranged in the forests of the colder parts of North America from the northern limit of timber line south to New England and New York; in the Rocky Mountains south to Colorado, and along the Sierra Nevada Mountains to Mount Whitney and Sequoia National Park, California. The inroad of settlement, the persistent hunting and trapping of the animal for its beautiful fur, the enmity the animal has gained by reason of its bad morals, as well as his taste for porcupine, has resulted in the animal's becoming extinct over the greater portion of its former range. Where still found, the individuals are few and scattered.

The last stand of the wolverine is in the western part of its range and it is becoming very rare. Wolverine are most abundant in the vicinity of Mount Whitney and Sequoia National Park. This fact is, perhaps, due to the ruggedness of the country and the protection afforded by the National Park service. Many of the animals have been killed in recent years near the park and were, no doubt, products of the park. The last capture was at Mineral King during the winter of 1921-22. Three animals were taken. All were fine specimens and in excellent condition. The largest weighed about 25 pounds. One of these skins is now on exhibit at the park museum at Giant Forest. This catch practically wiped out the species in the Mineral King district for the tracks of but one animal have since been observed in that vicinity.

Family and Description.

The wolverine is by far the largest and most formidable member of the weasel family. It is a strong, heavy-bodied animal seldom weighing over 25 pounds or exceeding 22 inches in height or 40 inches in length, with a tail about 8 inches long, covered with long, coarse hairs drooping to a brush. The head is short and wide with powerful jaws set with heavy teeth. The legs are short and heavy and the feet are armed with long, sharp claws. The coloring of the pelage is unique and beautiful being mixed with black, yellow and gray. The front and sides of the head are grayish while the body is black varying to chestnut brown with a broad, undefined yellowish band along the sides and over the hips, meeting at the base of the tail.

King Beast of the Sierras.

The wolverine, commonly speaking, is not an aggressive animal but will fight desperately when attacked or for the care of its young. When once engaged in combat the beast knows no such thing as retreat, dying, if need be, but never falling back. He fights on as long as a single spark of life remains. Mountain lion, bear and mountain coyotes, whether coming singly or collectively upon a wolverine, seem to fully realize his ferociousness and quickly give way to his path. They know, through long experience, that this is an animal which must be let alone so undoubtedly believe in the logic of "live and let live." The wolverine not only expects the larger animals to let him alone but requires them to give up their own prey and permit him to satisfy his gluttonous appetite.

That the wolverine ranks as king beast of the sierras, to me there is not a shadow of doubt. This fact is borne out by reason of my own observations as well as those of others who have noted their conduct toward other wild animals at certain times and at various places within Sequoia National Park—a few instances of which I will relate:

July 30, 1906—Two adult bear, one black and one brown, gave over to one adult wolverine, with excitement and great haste at Buck Canyon, the carcass of a cow upon which they were feeding.

October 1, 1907—Three large mountain coyotes that were feeding on the carcass of a horse at Grouse Flat vacated the vicinity immediately upon the approach of one medium-sized wolverine.

September 30, 1908—One large and one medium-sized mountain lion were feasting on a deer that they had recently killed at Willow Meadows, but after much growling and threatened resistance on the part of the larger lion both gave way to the approach of one medium-sized wolverine.

Feeding Habits.

The wolverine has no winning bursts of speed to catch his food supply; nor has he the gift of stalking his quarry. His lack of speed and skill has forced the animal to be a scavenger and eat anything in the way of flesh that is captured or found dead. He has a voracious appetite but no doubt can fast for many days, a condition to which he is often forced during the deep snow of winter. Because of his voracious appetite the animal is often called the "glutton." This seems appropriate, for not elsewhere in North America do I know of a mammal in proportion to its size with such capacity for coarse food at one given time, or which has such powerful organs for the digestion, as that of the wolverine. His principal food in the Sierra Nevada consists of the yellow-bellied marmots, carrion, gophers, rats and mice, with occasional sick or crippled wild animals which he is able to drag down. With his long claws and great strength he can dig very rapidly and catch many of the smaller rodents in their burrows. The wolverine does not hunt in mass formation, as do the wolves, but simply braves it alone in a solitary way.

Wolverine are tireless wanderers and do most of their traveling at night but when forced by hunger they will hunt by day. They have but little migratory impulse and usually remain in the vicinity where born. They do not dig burrows in which to live or for shelter and protection, as do some of their smaller brethren, but simply lie down in places at random, usually under some shelving rock or at the base of a tree.

Bad Morals.

The wolverine has very bad morals that have gained him the enmity of not a few. It often follows the trap lines of fur trappers, eating or destroying the catches, baits, and, at times, dragging away the traps.

It will also occasionally invade the rangers' and trappers' cabins by tearing a hole through the roof or side wall, destroy the food contents, and what it can neither eat nor carry away it defiles in such manner as to render it unfit for use. A wolverine will expend a surprising amount of labor in the carrying off and burying of foodstuffs and often include other articles for which it has no use.

Personal Experiences With Wolverine.

The tradition that wolverine are ready to attack any human being gives the impression of a very dangerous animal; but I regard it as pure fiction. On two occasions have I come upon wolverine alone in the daytime in their natural haunts in the Sequoia National Park, where they had probably never before been disturbed by man. Neither time did they show any signs of combat. From the actions of these two animals I base my belief that the wolverine will, under any ordinary circumstances, give way to the presence of man.

It was on the morning of August 31, 1905, that I came upon my first wolverine in the free state of his existence at the eastern edge of Giant Forest on the Alta trail, elevation 7500 feet. The animal was a very large one and was busily engaged in an effort to dig a "ground hog" from an embankment a few feet off the trail. He was making rapid progress. So determined was the animal in the pursuit of his quarry that not until I had approached within less than forty feet did he notice my presence; and when he saw me in such proximity it gave him a great shock of surprise and amazement such as he had perhaps never before had in his life—as was clearly demonstrated by his actions. He immediately sprang upon a large fir log at the butt of which I was standing and turned facing me, gave a coarse guttural growl and showed his teeth. His small, black, beadlike eyes were focused directly at my countenance as if to detect any signs of hostility. His nose was then hoisted high in the air as if to determine the unusual scent; the ears, which with respect to size and shape, resembled two silver dollars, stood well out from the head as if to grasp any unusual sound; the white, pearly claws of the front feet were occasionally scratched on the bark of the log as if preparing for immediate use in warfare.

After remaining in this statuesque attitude for some five minutes the beast advanced slowly on the log toward me and looked me direct in the face. When he had approached within about fifteen feet he suddenly stopped as if to collect his philosophical mind in reasoning out a proposition where death threatened him. His advance seemed for the purpose of getting a better look at me in order to ascertain more accurately as to just what sort of a being I was, or whether or not I was a hostile genus or hereditary enemy, for he showed no signs of anger, fear or aggression. However, at that very critical moment I had my pistol leveled at his heart and my finger on the trigger, with the expectation of matching my skill in marksmanship against his temper and grit in case he showed evidence of combat. He stood for a few seconds scrutinizing me from head to foot, then began to retreat by walking backwards on the log whence he came, for a distance of some thirty feet, sprang to the ground and departed in the forest. I followed the animal for a distance of some two hundred yards, but all the while he kept his distance and close watch of me by looking back over his shoulders. On three different occasions I stamped my feet rapidly on the ground as if in running pursuit, and on each occasion he would immediately right-about-face and advance a few steps toward me. Having amused myself after this fashion for some few minutes, the animal was permitted to go his own way into the depths of the forest.

The second wolverine I met was on the afternoon of July 30, 1906, at Buck Canyon, seven miles east of Giant Forest, elevation 7800 feet. This was the same animal to which I have referred as having driven two bears away from a carcass. Two men and myself in hiding some 150 feet away watched this affair without any of the animals detecting our presence. After the fracas had ended between the three animals and the wolverine was in possession of the carcass, I decided to make a test as to whether or not he would yield on my approach. I shifted my position by crawling a few paces to a huge boulder that stood within about fifty feet of him and between us. I then crawled up to the boulder, peeped round one side, and for a few moments watched his method of repast. The bears had left little but large bones which they were unable to chew; however, the wolverine crushed these as if they were mere chalk and swallowed them with rapacious delight. After watching the animal for some five minutes, pistol in hand, I stepped out in plain sight and advanced slowly toward him. The wolverine looked up at me, gave a coarse growl, grabbed a large bone in his mouth, then walked slowly into the depths of a dense cherry thicket.

Do Wolverines Climb Trees?

The question is often asked: "Do wolverines climb trees?" To this I would say that never have I seen wolverines climb trees, but I have a verified record of such.

The occurrence took place during the month of May, 1903, at Mineral King, California. Two forest rangers, Clarence W. Fry, Three Rivers, California, and William A. Hindman, Visalia, California, came suddenly upon a wolverine that climbed trees, and without hesitation. The animal, when first routed from its lair, gave a few jumps, climbed up a large fir tree some thirty feet, then backed to the ground quickly. When the animal reached the ground, upon being pursued closely by both men and a dog, it climbed up a second large fir tree a distance of some sixty feet, at which point it was shot and killed by Ranger Fry.

Breeding Habits.

Little is known about the breeding habits of the wolverine. It is supposed that young are born in June and range from one to four in number. Upon two occasions I have come upon beds in Sequoia National Park where young had been born and reared, as was plainly evidenced by the premises and surroundings. The first was found on the north spur of Mount Silliman on September 10, 1909, elevation 10,800 feet. The second was on the south side of Vandever Mountain on September 18, 1918, elevation 11,000 feet. In both cases the choice for beds or dens was under shelving rocks and but little preparation had been made for the occasion. A round-like excavation some six inches in depth and five feet in width, with scant lining of grasses and small pieces of pine boughs, comprised the whole. The strange feature of both lairs found was that no bones of the animals that had fallen victim of their prey could be found, as is always the case in such instances with the lion, bear, fox, wolf and lynx. No doubt these had been consumed by the parent mother as food, or carried away for some distance.

In all my mountain experience I have never yet heard a wolverine, when captured or otherwise, give voice to anything but a coarse, guttural growl. Perhaps through long experience they know the value of silence and prefer to keep secret their general whereabouts.

The wolverine is an animal endowed by nature with the strongest of constitution, philosophical mind and excellent reasoning power. Had this not been the case the species could not, with its many handicaps, have survived to this time. The wolverine's sense of smell and hearing is fair but his vision is short and his shape such that he is a poor runner. They do not hibernate in winter, as do the bear, but are forced to hunt daily for their living. Neither do they migrate to lowlands during deep snow periods in winter, as do many other animals, but brave the storm-swept elements on upper timber line where it would seem that no living thing could exist.

Should the Wolverine Be Protected or Exterminated?

The wolverine forms one of the most interesting members of California's fauna and steps should be taken for its immediate protection. Its extermination, to me, seems a very serious crime in which man will be held to strict accountability. Furthermore, I believe that these animals have played an important part in helping to save the larger game animals during attacks of contagious diseases by consuming as food the dead and sick animals, thus preventing spread of the contagion.

So the question now at issue is, "Is the wolverine worth while?" If so, it should be protected. If the wolverine is not worth preserving, at its present rate of extinction it will soon go down and out and will pass to join in history the mastodon and mammoth of the past.

NOTES ON THE EGG YIELD OF SACRAMENTO RIVER KING SALMON.

By E. A. MCGREGOR.

Last year the writer prepared a report on the egg yield of Klamath River king salmon.¹ The present paper continues this study as applied to 50 female king salmon taken in the Suisun portion of the Sacramento system.

The method of computing the number of ova has been the same in all of these studies, namely, careful weighing of the ovaries, determining the number of ova per 10 grams, and then calculating the total number. This method is really accurate enough for all purposes.

¹"Observations on the Egg Yield of Klamath River King Salmon," California Fish and Game, Vol. 8, No. 3.

TABLE No. 1. Analysis of 50 King Salmon Females as to Length and Ovary Characteristics.

Fish number	Weight, left ovary, grams	Weight, right ovary, grams	Eggs in left ovary	Eggs in right ovary	Total egg count	Length of fish, cm.
1	104	113	2,309	2,486	4,795	95
2	226	224	2,599	2,554	5,153	78
3	254	298	2,438	2,891	5,329	98
4	71	60	2,812	2,586	5,398	59
5	230	215	2,893	2,636	5,564	87
6	204	219	2,652	2,935	5,587	82
7	211	216	2,870	2,938	5,808	82
8	311	278	3,110	2,780	5,890	94
9	119	120	2,999	2,940	5,939	72
10	340	367	2,822	3,156	5,978	96
11	351	279	3,475	2,734	6,209	92
12	269	271	3,201	3,144	6,345	90
13	157	178	2,983	3,364	6,347	87
14	427	463	3,160	3,426	6,586	88
15	566	520	3,396	3,224	6,620	97
16	273	260	3,385	3,250	6,635	82
17	417	418	3,419	3,219	6,638	94
18	580	505	3,654	3,182	6,836	101
19	175	156	3,610	3,245	6,855	98
20	448	411	3,494	3,411	6,905	101
21	338	313	3,617	3,319	6,936	93
22	201	197	3,517	3,526	7,043	81
23	283	270	3,594	3,483	7,077	88
24	301	356	3,191	4,023	7,214	87
25	404	433	3,474	3,787	7,261	96
26	311	295	3,639	3,717	7,356	91
27	446	468	3,613	3,791	7,404	100
28	372	402	3,683	4,020	7,703	95
29	583	632	3,731	4,045	7,776	103
30	571	616	3,597	4,264	7,861	69
31	603	658	3,859	4,277	8,136	101
32	562	582	4,215	4,016	8,231	97
33	478	476	4,159	4,141	8,300	99
34	513	519	4,155	4,152	8,307	99
35	170	209	3,910	4,410	8,320	86
36	437	417	4,326	4,003	8,329	90
37	438	376	4,687	3,647	8,334	99
38	590	563	4,368	4,092	8,458	97
39	595	515	4,611	3,863	8,504	103
40	661	683	4,230	4,303	8,533	100
41	514	514	4,215	4,369	8,584	100
42	513	472	4,566	4,201	8,767	100
43	525	444	4,777	4,085	8,862	102
44	555	543	4,551	4,398	8,949	106
45	614	696	4,447	4,524	8,971	99
46	382	396	4,431	4,594	9,025	97
47	884	873	4,685	4,627	9,312	110
48	360	389	4,100	5,018	9,118	99
49	150	155	4,845	4,774	9,619	72
50	457	498	5,484	5,528	11,012	88
Average					7,422	

The present series (see Table 1) varies from 4795 to 11,012—a range of 6217, with a mean value of 7422. Twenty-seven fish had more ova in the left ovary while 23 fish had a greater number in the right ovary. This agrees with the condition found by Snyder to obtain with his Klamath River series, but is the reverse of the writer's findings with his ovary counts from the Klamath. Evidently neither ovary consistently exceeds in the number of ova.

Figure 31 presents a frequency chart in which are indicated the egg counts of the 98 king salmon from the Klamath River (previously treated in the above cited paper) as well as the egg counts of the present

series. Thus Klamath River and Sacramento River data are plotted side by side. The class interval is 200 eggs.

It is of great interest to note that the respective graphs (Klamath and Sacramento) each constitute, in the main, compact "curves," well defined from each other. The Klamath group is somewhat more symmetrical, probably owing to the presence of about double the number of cases. Doubtless a more symmetrical "curve" would have resulted in the case of the Sacramento data had we been in a position to chart twice the number of cases.

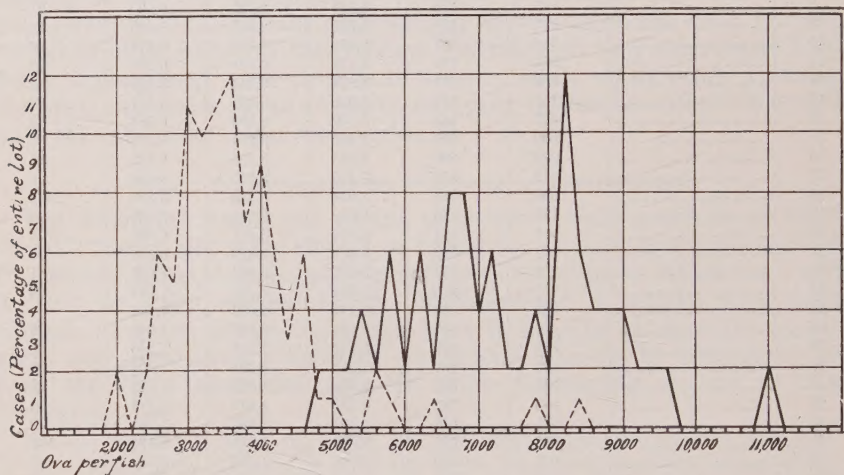


FIG. 31. Graph showing frequency distribution of the total egg counts in a collection of 98 king salmon from the Klamath River and a collection of 50 king salmon from the Sacramento River. (The horizontal ordinates represent percentages of the entire number of cases; the broken lines form the Klamath "curve"; the solid lines form the Sacramento "curve.")

In this connection it is pertinent to quote from our earlier paper:

There are four or five cases which do not conform nicely with the mass distribution of the series (Klamath). Concerning these aberrant cases, all we can offer by way of explanation is that it is barely possible that these fishes belong to a race or races of salmon alien to the Klamath River or to unusual races native to the Klamath River. If the former hypothesis be true they may be either "stragglers" or fish that have become established through the transplantation to the Klamath system of eggs from other streams.

A glance at figure 31 shows how nicely the above aberrant cases of the Klamath series coincide with the distribution of the Sacramento series. It is quite probable that these cases were in reality typical fish of the Sacramento race.

The mean value for the Sacramento egg counts, as already stated, is 7422 as opposed to 3891 for the mean of the Klamath series. However, the most outstanding feature to be detected through a comparison of the egg counts of the two river races is that there is almost no overlapping of the two series. Where one ends the other begins. Hence, it seems safe in stating that a salmon in the Klamath River with over 5000 ova is very possibly a Sacramento River fish; while a salmon in the Sacramento River with less than 4800 ova is probably alien to that stream, and quite possibly of the Klamath race.

As in the case of the Klamath ova studies, described in the earlier paper, so with the present series, there appears to be a correlation between the length of the fish and the number of ova. The third of the series with the fewest eggs average 92.4 cm. in length; the middle third average 93.8 cm.; while the third with the most eggs average 96.9 cm. in length.

Concerning the possibility of a relation between age and number of ova, little could be established with our material since the scales of some of the fish had commenced to become absorbed, making age determination impractical in such cases.

Certain workers have previously expressed the opinion that the Sacramento salmon exceeds in number of ova per fish that of the Klamath salmon. The results of the present studies compared with those reported in the 1921 paper establish the validity of these hitherto unproven views.

An interesting outgrowth of these studies is the quite obvious discrepancy between our data on the number of eggs per fish and similar estimates by the hatchery authorities. A hatchery analysis of the egg take at Klamathon for 1921 is as follows: Total females spawned, 5823; total eggs therefrom, 19,178,000; average number of ova per female, 3293. It has been seen that our data yields a mean ova value per female of 3891 for the Klamath race, the mode being at 3600 approximately. This means that we find about 18 per cent more eggs per female among fish of the spawning run at Requa (near mouth of river) than are spawned at the racks—based on hatchery estimates. Again, we are told that the records of the Battle Creek Hatchery, together with other evidence, show that the Sacramento salmon yields an average of about 6000 spawned ova per female. As we have stated, our careful counts indicate a mean value of 7453 eggs per set of ovaries for females from the Suisun district of the Sacramento system. This represents about 24 per cent more ova among fish of the spawning run near Martinez than are secured at the Battle Creek egg-taking station.

Just how to account for these discrepancies in egg counts a short time prior to and at spawning time is problematical. The theory might be advanced that, contained in the ovaries are certain ova, smaller than the general mass of ova, that become absorbed prior to spawning. It must be admitted that a small proportion of the ovaries examined have contained a negligible number of abortive ova, but an effort was made to eliminate these few undeveloped eggs from our estimates. Since absorption of these abortive ova presumably would advance (provided absorption occurs) with the maturing of the general mass of eggs, one would therefore expect (on this hypothesis) ovaries with further advanced eggs to exhibit, in general, egg counts somewhat less than the average for a given lot. On the contrary, as may seem strange, of that portion of the females containing eggs in excess of the mean number, about 75 per cent possessed eggs averaging larger than the average size of the entire lot. Consequently we are forced to the conclusion that the phenomenon of egg absorption does not operate to reduce the number of ova just prior to spawning.

We will leave the solution of this discrepancy between egg counts and egg estimates for a later problem.

In conclusion then, our studies indicate a very marked difference between the number of eggs developed by king salmon females of the Klamath and Sacramento races, respectively. Taking the weighted means as representative of the egg yields of the two river races (3891 and 7422), the number of eggs per female of the Sacramento type may be said to exceed that of the Klamath type by about 91 per cent of the Klamath yield.

As previously pointed out, these facts possess an economic bearing which may be utilized in practice at some later date.

A POSSIBLE SEPARATION OF THE RIVER RACES OF KING SALMON IN OCEAN-CAUGHT FISH BY MEANS OF ANATOMICAL CHARACTERS.

By E. A. MCGREGOR.

In connection with certain studies of rather ample series of gill rakers, pyloric coeca, branchiostegals and ova, and a limited number of vertebrae, some very suggestive developments have accrued which appear to bear vitally on the problem of the race analysis of ocean-captured salmon.

In the work of systematists, dealing previously with the Pacific coast salmon species, seemingly they have not had access to large series of specimens or, if they had, possibly they did not go to the trouble of tediously counting large series of the structures listed above. Consequently the ranges in their several series are not so great as might have been, and their data appear not to have aroused serious speculation as to the existence of well defined intraspecific racial differences. Recent studies by Dr. Chas. H. Gilbert, especially in the case of the sockeye salmon, have established the occurrence of several local races in British Columbia and Alaska.

In the following pages we shall attempt to present the data accumulated to date in such a way as to be useful in the future in connection with similar analytical studies of ocean-caught salmon.

Ova Counts.

In another paper¹ the writer has presented data emphasizing the marked difference in the number of ova as between the Klamath River and Sacramento River races of king salmon. Since preparing this paper we have added somewhat to our Klamath series, so we will again present the ova counts of the two races, bringing the comparisons up to date.

Table I presents the full series, consisting of 111 Klamath River king salmon. These were collected at three different times as follows: Those designated "S" were collected by Professor Snyder at Requa in 1920; those marked "R" were collected by the writer at Requa in 1921; those listed as "K" were collected by the writer at Klamathon (towards the head of the river) in 1922.

¹"Notes on the egg yield of Sacramento River king salmon" (in the present number of CALIFORNIA FISH AND GAME).

TABLE I. KING SALMON OVA COUNTS, KLAMATH RIVER.

No. of ova	Length, cm.	Date	No. of ova	Length, cm.	Date	No. of ova	Length, cm.	Date
R 8406	105	Sept. 1	R 3953	90	Aug. 24	R 3298	74	Aug. 27
R 7946	95	Sept. 5	S 3935	84	Aug. 12	R 3277	100	Sept. 2
R 6468	79	Sept. 2	R 3932	81	Aug. 27	K 3265	71	Oct. 17
R 5975	107	Sept. 3	R 3905	86	Aug. 18	R 3256	86	Aug. 12
R 5658	105	Sept. 6	R 3901	81	Sept. 1	S 3200	82	Aug. 12
R 5656	91	Aug. 9	S 3886	78	Aug. 12	R 3181	69	Aug. 19
R 5159	100	Sept. 3	K 3792	83	Oct. 19	R 3175	84	Aug. 31
K 4977	-----	Oct. 20	S 3781	82	Aug. 11	K 3174	80	Oct. 12
S 4842	87	Aug. 12	R 3743	87	Sept. 2	R 3139	70	Sept. 1
R 4728	93	Aug. 25	S 3731	84	Aug. 11	K 3130	-----	Oct. 20
R 4713	92	Aug. 20	R 3707	84	Aug. 26	S 3110	84	Aug. 11
R 4692	92	Aug. 22	K 3702	81	Oct. 20	R 3101	80	Aug. 24
R 4666	92	Aug. 26	S 3676	83	Aug. 12	S 3083	80	-----
R 4650	90	Aug. 27	S 3672	81	Aug. 12	R 3075	77	Aug. 20
R 4612	95	Sept. 1	R 3645	69	Aug. 12	R 3070	76	Aug. 24
R 4586	89	Aug. 15	S 3630	83	Aug. 12	K 3057	73	Oct. 12
K 4544	86	Oct. 15	R 3625	70	Aug. 20	R 3046	81	Sept. 6
K 4479	84	Oct. 15	R 3623	88	Aug. 25	R 3046	71	Aug. 22
R 4452	-----	-----	S 3614	83	-----	R 3035	-----	-----
R 4429	91	Aug. 9	R 3613	81	Aug. 15	R 2973	68	Aug. 16
R 4399	94	Aug. 16	R 3593	86	Aug. 24	S 2949	77	Aug. 12
S 4392	87	Aug. 12	S 3586	75	Aug. 12	K 2944	72	Oct. 12
R 4322	69	Aug. 1	S 3579	69	Aug. 12	S 2879	72	Aug. 12
R 4305	91	Aug. 18	R 3553	78	Aug. 31	S 2847	77	Aug. 12
S 4300	82	Aug. 12	R 3537	75	Aug. 18	R 2823	70	Aug. 24
S 4200	87	-----	R 3523	82	Aug. 25	K 2830	75	Oct. 15
S 4197	77	Aug. 12	R 3486	91	Aug. 31	S 2745	80	Aug. 12
S 4192	83	Aug. 12	S 3467	81	Aug. 12	R 2738	73	Aug. 31
R 4190	79	Aug. 19	R 3446	88	Sept. 3	S 2700	79	Aug. 12
R 4168	86	Aug. 16	R 3413	71	Sept. 5	R 2695	85	Aug. 16
R 4155	89	Aug. 26	S 3403	79	Aug. 12	R 2632	68	Aug. 15
R 4150	80	Sept. 5	R 3373	73	Aug. 16	R 2601	66	Sept. 2
S 4117	95	Aug. 12	R 3360	71	Aug. 26	R 2501	61	Aug. 12
R 4061	-----	-----	R 3347	77	Aug. 4	R 2471	65	Aug. 27
K 4039	84	Oct. 17	S 3305	71	Aug. 12	S 2146	67	Aug. 28
S 4009	80	-----	R 3305	66	Aug. 18	R 2013	92	Aug. 15
R 3994	93	Aug. 19	R 3303	86	Aug. 19	K 1718	55	Oct. 13

Mean value, 3760 ova.

It will be noted that there is a wide range in the number of ova, namely, from 1718 to 8406 per female. The computed mean value for the series is found to be 3760 ova. It is not unlikely that a more detailed study of the Klamath River salmon may demonstrate the existence of several more or less recognizable local subraces characteristic of certain tributaries.

It will be further noted that the seven individuals at the maximum extreme of the series constitute (with a single exception) a homogeneous group. All but one returned to the stream during September and all, with one exception, were very large females. As will be seen later, evidence would seem to indicate that the females with over 5000 ova (although taken in the Klamath River) may be of the Sacramento race.

Table II presents our available data dealing with the ova counts of 50 king salmon of the Sacramento system, taken at Martinez, September, 1922.

Here too, we find the existence of a remarkably large range in the number of ova per female. The extremes were, respectively, 4795 and 11,012 ova per female. The computed mean for this series was found to be 7454 ova, almost double the mean of the Klamath series. As we have surmised regarding the Klamath River salmon, so also with the Sacramento run, it is quite likely that more exhaustive studies of the

salmon of this river may bring to light the occurrence of several local subraces.

TABLE II. KING SALMON OVA COUNTS, SACRAMENTO RIVER.

No. of ova	Length, cm.	Date	No. of ova	Length, cm.	Date	No. of ova	Length, cm.	Date
11,012	88	Sept. 6	8300	99	Sept. 6	6635	82	Sept. 6
9619	72	Sept. 7	8231	97	Sept. 6	6620	97	Sept. 6
9518	99	Sept. 6	8136	101	Sept. 6	6586	88	Sept. 6
9312	110	Sept. 7	7861	69	Sept. 6	6347	87	Sept. 6
9025	97	Sept. 7	7776	103	Sept. 6	6345	90	Sept. 6
8971	99	Sept. 7	7703	95	Sept. 6	6209	92	Sept. 6
8949	106	Sept. 6	7404	100	Sept. 6	5978	96	Sept. 6
8862	102	Sept. 6	7356	91	Sept. 6	5939	72	Sept. 6
8767	100	Sept. 7	7241	96	Sept. 6	5890	94	Sept. 7
8584	100	Sept. 7	7214	87	Sept. 6	5808	82	Sept. 6
8533	100	Sept. 6	7077	88	Sept. 6	5587	82	Sept. 7
8504	103	Sept. 7	7043	81	Sept. 6	5564	87	Sept. 6
8458	97	Sept. 6	6966	93	Sept. 6	5398	59	Sept. 6
8334	99	Sept. 6	6905	101	Sept. 7	5329	98	Sept. 6
8329	90	Sept. 6	6885	98	Sept. 6	5153	78	Sept. 6
8320	86	Sept. 7	6836	101	Sept. 7	4795	95	Sept. 6
8307	99	Sept. 6	6638	94	Sept. 7			

Mean value, 7453.8.

Table III contains the ova counts from 58 king salmon taken by troll in the ocean off Noyo River and Shelter Cove, Mendocino County, during the period from June 21 to August 12, 1922.

TABLE III. KING SALMON OVA COUNTS, FORT BRAGG—1922.

No. of ova	Length, cm.	Date	No. of ova	Length, cm.	Date	No. of ova	Length, cm.	Date
9021	79	June 23	5093	83	July 8	3910	66	June 25
8829	73	June 24	5042	81	June 23	3867	77	June 22
8258	70	July 6	4960	88	July 1	3854	80	July 10
7618	95	Aug. 11	4858	82	June 26	3646	81	June 25
7272	67	June 26	4783	88	June 26	3614	76	June 22
7068	77	July 1	4729	83	June 27	3555	82	July 8
6917	77	July 1	4621	85	June 23	3526	93	June 29
6851	78	June 28	4437	83	June 23	3521	77	June 27
6715	85	June 21	4377	75	June 23	3497	78	June 21
6358	109	June 29	4330	75	June 26	3477	73	July 7
6309	77	June 23	4297	98	July 1	3487	79	June 27
6287	90	Aug. 5	4247	98	July 26	3390	78	July 10
6269	61	June 27	4148	74	July 20	3344		
6192	79	June 22	4142			3321	94	June 21
6008	76	July 3	4062	87	June 26	3317	75	June 30
5972	58	June 25	4035	78	June 22	3266		
5768	93	Aug. 12	4033	76	June 26	3214		
5450	78	June 23	4018			3147	78	June 27
5370	88	June 26	4008	81	June 29			
5094	72	July 1	3988	98	June 21			

Mean value, 4910 ova.

Again we note a very considerable range, namely, from 3147 to 9021 ova per female. The mean is computed to be 4910.

In figure 32 we have constructed three "curves" based on the data contained in tables I, II and III. In these graphs the data have been recorded in terms of percentage rather than of absolute values. A few very significant facts are to be deduced from the presentation of our data in this manner.

Referring to figure 32 it is at once noticeable that the "curves" representing respectively the Klamath and Sacramento ova series are quite

distinct from one another. Were we to ignore the six aberrant cases of the Klamath series (referred to above as probably belonging to the Sacramento race), we might say there were little, if indeed any, overlapping of the two "curves." The cleavage between the two series would appear to be coincident approximately with the 5200 ordinate.

A third "curve" will be noted in figure 32. This is constructed from the data embracing the ova counts of the series of king salmon females

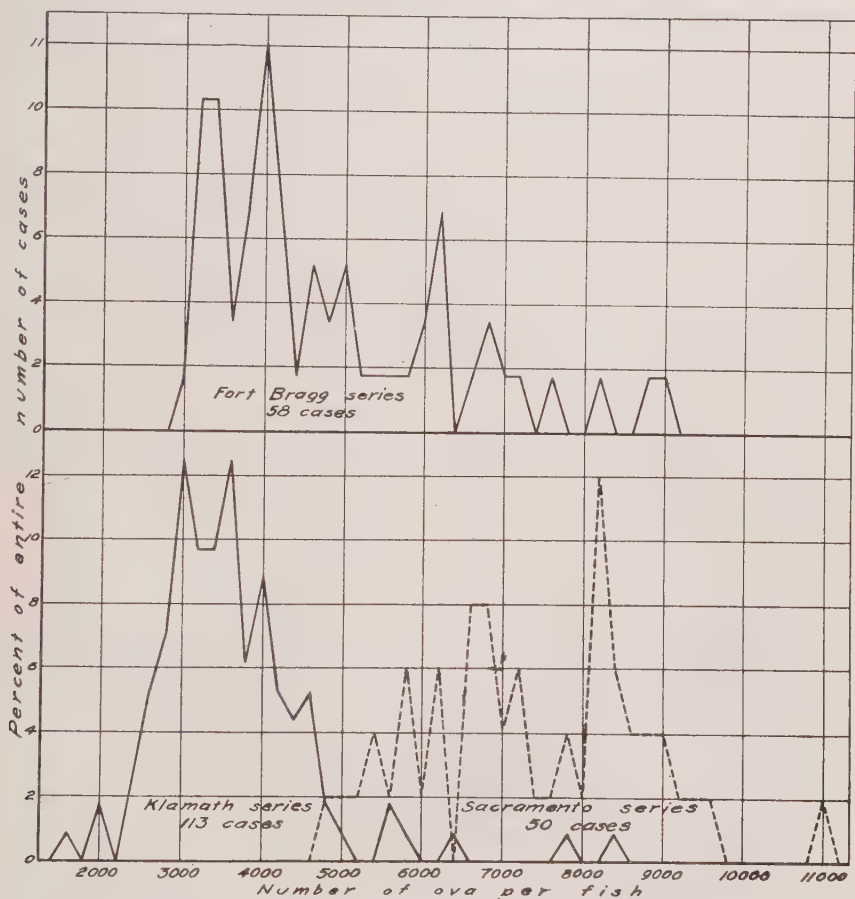


FIG. 32. Graph comparing number of ova per fish in Fort Bragg, Klamath and Sacramento series of salmon.

from the ocean at Fort Bragg. This "curve" is plotted in direct relation with the "curves" of the Klamath and Sacramento series. When considered together, we find that the ocean "curve" is nearly coextensive with the combined Klamath and Sacramento "curves." Corresponding with the cleavage between the series of the two rivers there is seen to be similarly a fairly well defined cleavage at the 5200 ordinate of the Fort Bragg "curve." Below the cleavage there are 41 cases; above the cleavage, 17 cases.

It is possible, of course, that there may be represented in the Fort Bragg series salmon from streams other than the Sacramento and Klamath Rivers. It seems, however, quite reasonable to presume that the great majority of king salmon occurring off Fort Bragg belong to the two California streams which support the major runs of the state. If this supposition be true, our ova data would seem to justify the rough estimate that 70 per cent of the king salmon caught off Fort Bragg and Shelter Cove during the period of our observations in 1922 were of the Klamath race while only 30 per cent of these sea-caught fish were of the Sacramento race. It should again be emphasized that our data from Fort Bragg were collected at various dates, representing fairly well the major portion of the fishing season at that locality.

One might attempt a more refined interpretation of the several "curves" than we have done. The depression of the Sacramento "curve" at about the 7500 ordinate may or may not be significant. It is quite possible that accessibility to a larger series of individuals might obliterate this apparent cleavage. Should a depression of the "curve" at this point persist with the study of a very large series of ova, it would indicate strongly the occurrence in the Sacramento River system of at least two races of salmon with rather distinct ova count values. It may indicate a demarkation between Sacramento and San Joaquin River fish.

TABLE IV. PYLORIC COECA DATA FROM KLAMATH RIVER KING SALMON.

Number of coeca-----	Average length of 3 longest, cm.-----	Length of fish, cm.---	Date-----	Locality----	Number of coeca-----	Average length of 3 longest, cm.-----	Length of fish, cm.---	Date-----	Locality----
193	5.9	67.5	Oct. 10, 1919	R	131	8.3	92.5	Oct. 8, 1919	R
187	4.7	60.0	Oct. 11, 1919	R	130	3.7	83.0	Oct. 13, 1919	K
164	7.3	87.0	Oct. 7, 1919	R	130	3.2	82.0	Oct. 12, 1922	K
153	5.4	-----	Aug. 28, 1919	R	130	4.3	53.0	July 30, 1920	R
152	11.0	-----	Aug. 28, 1919	R	128	7.5	-----	Aug. 28, 1919	R
152	8.9	-----	Aug. 28, 1919	R	128	10.5	103.0	Oct. 14, 1919	R
151	7.5	-----	Aug. 28, 1919	R	128	7.5	83.5	Oct. 14, 1919	R
151	7.3	-----	Aug. 28, 1919	R	127	6.9	-----	Aug. 28, 1919	R
150	16.5	-----	-----	R	127	4.5	-----	Oct. 14, 1919	R
149	3.4	81.0	Oct. 20, 1922	K	127	4.3	73.0	Oct. 16, 1922	K
148	6.1	-----	Aug. 28, 1919	R	127	3.5	68.0	Oct. 13, 1922	K
148	9.7	-----	Aug. 28, 1919	R	125	9.1	-----	Aug. 28, 1919	R
148	7.9	-----	-----	R	125	9.4	-----	Aug. 28, 1919	R
146	3.2	82.0	Oct. 13, 1922	K	124	4.4	84.0	Oct. 13, 1922	K
145	2.9	77.0	Oct. 13, 1922	K	124	4.4	86.0	Oct. 15, 1922	K
144	9.2	-----	Oct. 28, 1919	R	124	3.2	74.0	Oct. 13, 1922	K
144	8.7	94.5	Oct. 6, 1919	R	124	7.7	-----	Aug. 28, 1919	R
144	5.8	63.5	Oct. 6, 1919	R	123	5.9	55.0	July 30, 1920	R
144	8.3	97.5	Oct. 7, 1919	R	122	8.5	-----	Aug. 28, 1919	R
142	8.1	-----	Aug. 28, 1919	R	121	8.3	-----	Aug. 28, 1919	R
142	2.7	73.0	Oct. 12, 1922	K	119	7.6	-----	Aug. 28, 1919	R
141	7.1	-----	Aug. 28, 1919	R	119	2.1	52.0	Oct. 14, 1922	K
140	2.8	78.0	Oct. 12, 1922	K	119	2.8	77.0	Oct. 16, 1922	K
138	3.0	96.0	Oct. 12, 1922	K	118	3.6	83.0	Oct. 12, 1922	K
136	7.1	60.0	Aug. 4, 1920	R	117	4.3	41.5	Oct. 6, 1919	R
135	8.7	93.0	Oct. 7, 1919	R	116	6.4	-----	Aug. 28, 1919	R
135	8.0	104.0	Oct. 14, 1919	R	114	2.2	80.0	Oct. 16, 1922	K
135	2.8	81.0	Oct. 13, 1922	K	114	6.5	56.5	Oct. 11, 1919	R
134	8.8	-----	Aug. 28, 1919	R	109	-----	81.0	Oct. 12, 1922	K
133	5.8	-----	Aug. 28, 1919	R	108	5.0	-----	Oct. 14, 1919	R
133	3.6	76.0	Oct. 13, 1922	K	107	4.3	82.0	Oct. 12, 1922	K
133	4.6	84.0	Oct. 17, 1922	K	102	-----	55.0	Oct. 13, 1922	K
132	12.1	97.5	Oct. 14, 1919	R	93	4.2	-----	Oct. 20, 1922	K

Average 132.2.

Pyloric Coeca Counts.

We have made also a good many counts of pyloric coeca from the stomachs of king salmon taken at various localities.

A series of 66 king salmon stomachs were collected on the Klamath River and later examined. These were all from mature fish on their spawning run. Forty-two were taken in the estuary at the mouth of the river, the balance, 24, were collected at the Klamath racks, 170 miles upstream from the coast.

TABLE V. PYLORIC COECA DATA FROM SACRAMENTO RIVER KING SALMON.

Number of coeca	Average length of 3 longest coeca, cm.	Length of fish, cm.	Date	Number of coeca	Average length of 3 longest coeca, cm.	Length of fish, cm.	Date
214	7.7	98	Sept. 6	177	7.1	88	Sept. 6
208	9.7	95	Sept. 6	177	7.5	82	Sept. 6
206	4.6	64	Sept. 7	176	4.6	64	Sept. 6
205	2.8			176	8.1	91	Sept. 6
205	4.4	67	Sept. 6	175	6.0	101	Sept. 7
203	9.2	100	Sept. 7	175	9.7	117	Sept. 6
203	5.6	98	Sept. 6	174	9.2	98	Sept. 7
200	11.7	116	Sept. 6	174	6.7	90	Sept. 6
199	8.6	93	Sept. 7	174	6.2	81	Sept. 6
198	8.0	82	Sept. 7	174	10.5	101	Sept. 6
198	9.4	106	Sept. 6	168	7.9	99	Sept. 6
197	6.8	72	Sept. 7	168	6.8	79	Sept. 6
197	8.8	88	Sept. 6	168	6.8	90	Sept. 6
195	7.8	78	Sept. 7	166	8.9	101	Sept. 6
195		88	Sept. 6	165	8.1	99	Sept. 6
195	3.3	84	Nov. 10	165	6.3	92	Sept. 6
194	4.5	57	Sept. 7	164	9.2	87	Sept. 6
194	7.8	97	Sept. 6	163	8.9	103	Sept. 6
193	7.0	94	Sept. 7	164	8.1	88	Sept. 6
193				162	8.1	87	Sept. 6
192	7.3	100	Sept. 7	162	7.1	97	Sept. 6
192	10.0	95	Sept. 5	162	3.0	68	Nov. 8
192	6.2	67	Sept. 6	161	8.2	97	Sept. 6
192	9.4	80	Sept. 6	160	9.4	101	Sept. 7
191	3.8	86	Nov. 11	158	10.5	96	Sept. 6
189	7.9	98	Sept. 6	157	6.3	97	Sept. 6
188	6.5	100	Sept. 6	156	6.4	69	Sept. 6
187	8.3	87	Sept. 6	155	8.9	114	Sept. 7
187	7.2	100	Sept. 6	155	4.3	84	Nov. 3
187				150	6.8	97	Sept. 6
186	8.8	99	Sept. 6	149	5.6	78	Sept. 6
184	6.7	97	Sept. 7	149	8.2	99	Sept. 6
183	8.1	99	Sept. 7	147	8.4	99	Sept. 6
182	2.8	80	Nov. 8	147	10.0	84	Sept. 6
181	8.3	103	Sept. 7	146	5.7	62	Sept. 6
181	7.2	90	Sept. 6	145	9.8	110	Sept. 7
180	8.4	69	Sept. 6	140	7.9	72	Sept. 6
178	7.3	94	Sept. 7	136	7.3	86	Sept. 7
178	9.2	83	Sept. 6	135	9.0	103	Sept. 7
178	9.4	82	Sept. 6	134	4.5	59	Sept. 6
177	8.0	99	Sept. 6				

Average, 176.4.

¹NOTE.—The few individuals of November in this table were taken at the Klamath racks on the Klamath River; being marked fish we know them to be of Sacramento River origin and are included with the balance which were taken at Martinez.

The frequency range of this Klamath River series (see Table IV) is from 93 to 193 coeca per stomach, with a mean value of 132.2 coeca. The three highest counts (164, 187 and 193) appear to fall far out of the regular distribution of the series. This is shown more clearly by referring to the graphic plotting of the data in figure 33. It is very probable that these three aberrant cases are individuals belonging to a race other than that normally inhabiting the Klamath River. We have computed that about 93 per cent of all the coeca cases of the Klamath series are contained between the 107 and the 153 ordinates, inclusive.

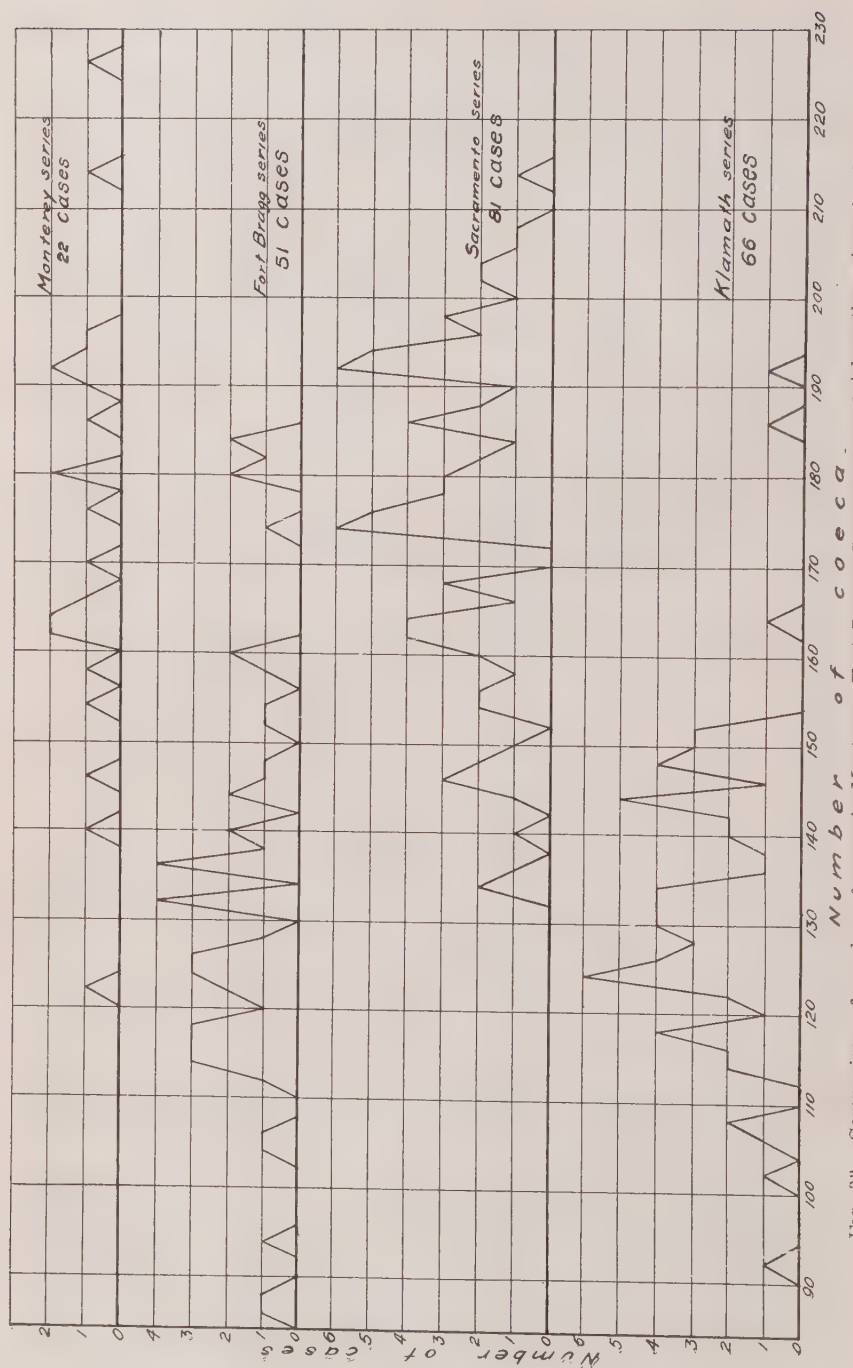


Fig. 33. Comparison of number of coeca in Monterey, Fort Bragg, Sacramento and Klamath series of salmon.

A series of 81 king salmon stomachs were collected at Martinez on Suisun Bay, just below the mouth of the Sacramento River. While there is a possibility that a portion of these individuals may have been heading for the San Joaquin River, still it is more than likely that the great mass, if not all of them, were typical Sacramento River fish and we shall speak of them as such in the present paper.

In Table V we present the coeca counts of this series arranged in orderly sequence. It will be seen that the case distribution ranges from 134 to 214 coeca (about 95 per cent of all the cases occur on the upper side of the 144 ordinate). The mean value for the series is 176.4 coeca.

Referring again to figure 33 we see the coeca counts of the Sacramento River series plotted in relation to the Klamath River counts. As one might expect, there is a degree of overlapping of the "curves" representing the coeca counts of the two great river systems. The striking feature, however, is that the overlapping is so slight! If, arbitrarily, we erect a vertical between the 153 and 154 ordinates, the Sacramento cases below this division line constitute but 13.5 per cent of the entire Martinez lot, while the Klamath cases above this dividing line amount to only 4.5 per cent of all the Klamath River cases. And, as we have suggested above, some of these overlapping cases probably represent straggling individuals from the stream within whose coeca series they appear to fall. Hence, if we could definitely eliminate these disconcerting cases it would be seen that the pyloric coeca values of the Klamath and Sacramento rivers would become strikingly distinct from one another. As it is, they are sufficiently well separated.

We now will consider the coeca counts of king salmon taken by troll in the ocean off Fort Bragg, Mendocino County. In this series there are 51 cases, ranging from 87 to 185 coeca, with the mean value at 134.1 coeca (see Table VI).

TABLE VI. PYLORIC COECA DATA FROM FORT BRAGG KING SALMON.

Number of coeca	Average length of 3 longest coeca, cm.	Length of fish, cm.	Date	Number of coeca	Average length of 3 longest coeca, cm.	Length of fish, cm.	Date
185	11.6	78	1922 June 23	132	5.6	41	July 10
185	4.5			129	13.5	82	June 26
182	8.4	78	June 28	127	11.0	76	July 3
180	12.2	109	June 29	126	10.3	77	July 1
180	9.7	77	June 23	126	11.1	83	June 23
174	11.4	78	July 20	125	14.1	93	Aug. 12
161		79	June 23	125	11.9	77	July 1
160	9.0	81	June 23	124	11.6	85	June 23
158	12.0			123	10.3	77	June 22
155	7.8	70	July 6	123	13.5	90	Aug. 5
152	13.4			121	13.8	88	Aug. 2
149	9.0	61	June 27	119	10.0	75	June 23
146	8.5	79	June 22	118	12.4	76	June 26
144	9.5	74	June 20	118	11.1	86	July 19
144	8.2	66	June 25	117	11.1	67	June 26
141	11.1	72	July 1	117	11.7		
140	9.8	79	Aug. 2	116	11.5	88	June 26
138	9.5	79	June 27	115	9.5	77	June 27
136	11.3	78	June 21	114	12.2	78	June 27
136	12.7	85	June 21	114	10.3	81	June 29
136	7.5	58	June 25	112		81	June 25
136	13.3	95	Aug. 11	107	13.3	75	June 26
132	14.0	83	June 27	105	11.1	78	June 22
132	14.1	88	July 1	94	9.2	76	June 22
132	11.6			88	12.1	79	July 8
				87		75	June 30

Average number of coeca, 134.1; average length of three longest coeca 10.9 cm.

It is of much interest once more to attempt to analyze the Fort Bragg salmon with reference to the particular river systems to which they may belong. Such a diagnosis is facilitated by referring again to figure 33. Here we see the ocean series of pyloric coeca counts plotted with reference both to the Klamath and the Sacramento coeca series. Considering as before the typical Klamath and Sacramento individuals to be separable by an ordinate erected between the 153 and 154 coeca values, it is of significance to note where this vertical cuts the Fort Bragg series. The great mass of the Fort Bragg collection is seen to fall below this ordinate. In fact, 80.4 per cent (41 cases) of the coeca counts from Fort Bragg coincide perfectly with the frequency distribution of the Klamath coeca counts (based on the validity of our selected dividing ordinate).

Naturally one must guard against formulating generalities supported by the study of series no larger than our present one from Fort Bragg. As briefly mentioned above, however, these studies covered the interval between June 20 and August 12, a very considerable portion of the commercial fishing season at that locality. The longest hiatus without data was 13 days (July 20 to August 2); the average interval between collections was 2.8 days. It would seem, therefore, that our 51 pyloric coeca counts from king salmon at Fort Bragg might form a reasonably fair basis upon which to compute a purely tentative analysis of the composition of the catch at that point. We may be justified in stating that our data of 1922 rather strongly indicate that the king salmon caught at sea off Fort Bragg during the period of our investigations were chiefly of the Klamath River type.

By referring to Table VI the following facts are to be noted for the Fort Bragg series (provided the two river races are recognizable in our data). First, the Sacramento fish were restricted to the period prior to and including July 20. Second, all August fish had coeca counts between 121 and 140. Lastly, Klamath River salmon were taken throughout the period from June 20 to August 12 (the entire period of observation).

TABLE VII. PYLORIC COECA DATA FROM MONTEREY KING SALMON.

Number of coeca	Average length of 3 longest coeca, cm.	Length of fish, cm.	Date	Number of coeca	Average length of 3 longest coeca, cm.	Length of fish, cm.	Date
			1920				
226	2.19	47	June 11	171	2.94	59	June 11
215	3.31	72	June 24	167	2.87	55	June 11
196	2.37	58	June 24	165	4.62	88	June 22
194	3.50	86	June 11	165	4.81	90	June 24
192	3.50	68	June 24	162	3.19	59	June 11
192	4.25	86	June 22	162	2.50	54	June 24
191	3.43	64	June 24	159	3.43	86	June 22
187	2.31	53	June 24	155	4.62	85	June 24
181	4.12	83	June 24	146	6.87	109	June 11
181	4.00	76	June 24	141	5.87	97	June 22
177	2.37	51	June 11	123	5.50	88	June 22

Mean, 174.9.

The coeca of 22 king salmon caught in Monterey Bay have been counted. This very limited series was collected at intervals during the period between June 11 and June 24, inclusive. The counts (see

Table VII) varied from 123 to 226, with a mean value of 174.9 coeca—almost identical with the mean value of the pyloric coeca series of the Sacramento River fish. These are also plotted in figure 33 (as were the Fort Bragg coeca counts) in direct relation with the Klamath and Sacramento series. It will be seen that our ordinate, selected to best separate the Klamath and Sacramento fish, cuts the Monterey series in such a way as to throw 19 individuals into the Sacramento group and only three individuals into the Klamath series. Reducing these quotas to terms of percentage, the above diagnosis suggests a Sacramento River representation of 86 per cent and a Klamath River quota of 14 per cent of the Monterey series. This collection is far too small to justify serious conclusions and we have included the data merely for what it may be worth.

Gill Raker Counts.

Our third anatomical character which we have utilized in the separation of the Klamath and Sacramento races of king salmon consists of the number of gill rakers on the first branchial arch. As in the case of the ova and coeca counts, so with the gill rakers, we have three series: One each from the Sacramento and the Klamath systems and one from ocean-trolled fish off Fort Bragg.

The data concerning Sacramento salmon were secured from Martinez (on Suisun Bay) and from hatchery fish. The series consists of 35 cases and the counts are as follows: 21 gill rakers, 1 case; 22 gill rakers, 7 cases; 23 gill rakers, 10 cases; 24 gill rakers, 9 cases; 25 gill rakers, 8 cases. Thus we have a range from 21 to 25 gill rakers with a mean value of 23.5 gill rakers.

The data respecting Klamath River salmon were secured from three sources: The estuary at the mouth of the river; the Klamathon racks, far up the river, and at the hatcheries. In all, 51 gill arches were examined with the following results: 24 gill rakers, 2 cases; 25 gill rakers, 3 cases; 26 gill rakers, 10 cases; 27 gill rakers, 10 cases; 28 gill rakers, 14 cases; 29 gill rakers, 9 cases; 30 gill rakers, 3 cases. This yields a range of 24 to 30 gill rakers and a mean value of 27.4 gill rakers.

Our gill raker data in the case of the Fort Bragg king salmon were secured from a series of 51 individuals as follows: 22 gill rakers, 3 cases; 23 gill rakers, 2 cases; 24 gill rakers, 2 cases; 25 gill rakers, 8 cases; 26 gill rakers, 10 cases; 27 gill rakers, 16 cases; 28 gill rakers, 7 cases; 29 gill rakers, 1 case; 30 gill rakers, 1 case; 31 gill rakers, 1 case. Here we have a range in gill raker values from 22 to 31 with a mean value of 26.2.

TABLE VIII. GILL RAKER COUNTS FOR SACRAMENTO, KLAMATH AND FORT BRAGG KING SALMON.

Gill rakers	21	22	23	24	25	26	27	28	29	30	31	Mean
Sacramento River fish.....	1	7	10	9	8	—	—	—	—	—	—	23.5
Klamath River fish.....	—	—	—	2	3	10	10	14	9	3	—	27.4
Fort Bragg fish.....	—	—	3	2	2	8	10	16	7	1	1	26.2

Again it is of much interest to see what can be done in the way of isolating either Sacramento River or Klamath River salmon from the ocean catch at Fort Bragg, using the gill raker counts. By referring to

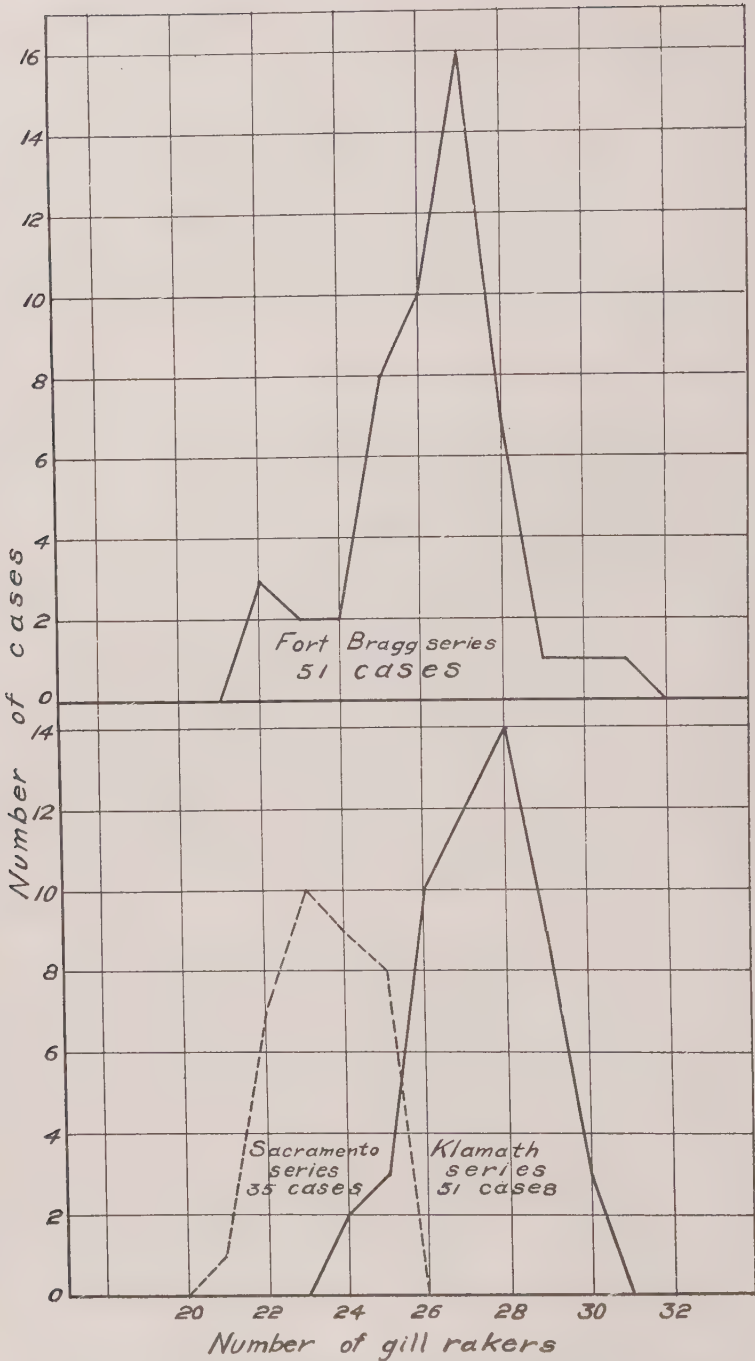


FIG. 34. Comparison of the number of gill rakers in Fort Bragg, Sacramento and Klamath series of salmon.

figure 34 wherein the various gill raker counts have been graphically presented, we are able to fix upon a vertical between the 24 and 25 ordinates as the most logical cleavage line between the gill raker values for the Sacramento and the Klamath River race. It is rather unusual that, whereas in the Sacramento series eight individuals had 25 gill rakers, none had 26. Probably a larger series would contain a few individuals with 26 gill rakers, resulting in a slightly increased overlapping of the "curves." Assuming, then, that five of the Fort Bragg individuals with gill raker counts of 25 are referable to the Sacramento race, we may, on the basis of our assumed dividing ordinate, analyze our Fort Bragg series as follows:

	Number of cases	Per cent
Klamath race -----	39	76.5
Sacramento race -----	12	23.5
Totals -----	51	100

This agrees nicely with the similar analysis of the Fort Bragg series based on the pyloric coeca counts.

In the case of the particular individuals in the Fort Bragg series having coeca counts above our dividing ordinate and suggesting that they may belong with the Sacramento race, we have subjected them to a similar test with reference to the arbitrary gill raker ordinate. Of these nine individuals five are seen to have more than 25 gill rakers, which places them with the Klamath race; the other four fall with the Sacramento series.

Again, we have compared these same individuals with reference to coeca and ova counts and find that every individual whose coeca count indicated it to be of the Sacramento race had ova counts above 5000, thus agreeing in this respect also with the Sacramento characteristics. These comparisons we tabulate below:

Collection number	Coeca	Gill rakers	Ova
1995 -----	185 (S)	23	5450 (S)
2119 -----	185 (S)	27	5693 (S)
1908 -----	182 (S)	22 (S)	6851 (S)
1912 -----	180 (S)	27	6358 (S)
1994 -----	180 (S)	26	6309 (S)
2116 -----	174 (S)	25 (S)	-----
1838 -----	161 (S)	25 (S)	9021 (S)
1992 -----	160 (S)	26	5042 (S)
2023 -----	155 (S)	24 (S)	8258 (S)

With regard, then, to our nine doubtful individuals, four of them (concurring nicely in ova, coeca and gill raker characters) may be placed with much confidence with the Sacramento race. This leaves a residue of only five individuals which appear not to belong with the latter race. These fish seemingly belong to a race which possesses the coeca and ova characteristics of the Sacramento salmon but have the gill raker traits of the Klamath fish.

Therefore, on the basis of this comparative analysis of the few doubtful coeca counts from Fort Bragg, we compute that approximately 82 per cent of the entire Fort Bragg series are of the Klamath race, 8 per cent are of the Sacramento race, while 10 per cent are of a doubtful source.

Vertebra Counts.

The writer has recently conducted some experiments with the use of X-rays for the vertebral examination of fishes. A report of this work, now in manuscript form, will give the details of the technique and we will merely state here that in connection with our X-ray operations we made some radiographs of Klamath River and Sacramento River king salmon. The results of these are listed below.

TABLE IX. VERTEBRA COUNTS OF KING SALMON "FRY" SECURED BY RADIOGRAPHS.

Klamath Estuary Sept. 20 1921	Fall Creek Hatchery (Klamath ova) Sept., 1922	Fall Creek Hatchery (Sacramento ova) Nov., 1919
No. 1=62+6=68 vertebrae	No. 1=61+6=67 vertebrae	No. 1=58+6=64 vertebrae
No. 2=61+6=67 vertebrae	No. 2=60+6=66 vertebrae	No. 2=56+6=62 vertebrae
No. 3=62+6=68 vertebrae	No. 3=61+6=67 vertebrae	No. 3= 9+6=65 vertebrae
No. 4=62+6=68 vertebrae	No. 4=60+6=66 vertebrae	No. 4=59+6=65 vertebrae
No. 5=60+6=66 vertebrae	No. 5=60+6=66 vertebrae	No. 5=56+6=62 vertebrae
No. 6=62+6=68 vertebrae	-----	No. 6=59+6=65 vertebrae
Mean, 67.5 vertebrae	Mean, 66.4 vertebrae	Mean, 63.8 vertebrae

The formula here used to express the vertebral count is applied as follows: The second value denotes the number of vertebrae involved in the caudal support; the first value denotes the number of vertebrae preceding those just described; the last value represents the total number of vertebrae (not counting the urostyle).

It will be seen that the number of vertebrae of the Klamath River race exhibits a range of from 66 to 68, with a weighted mean of 67.0. Those of the Sacramento race show a range of from 62 to 65 vertebrae with a mean of 63.8. In this case there is no overlapping of the two series, but this phenomenon might occur to some extent were we to examine a larger number of individuals.

Table X presents in condensed summary form the results of the present investigation.

TABLE X. ANATOMICAL FEATURES OF KING SALMON OF THE KLAMATH AND SACRAMENTO RACES AND OF FORT BRAGG OCEAN-CAUGHT CHINOOK.

	Klamath series		Sacramento series		Fort Bragg series	
	Range	Mean	Range	Mean	Range	Mean
Ova counts -----	1,718 to 4,977	3,760	4,795 to 11,012	7,453	3,147 to 9,021	4,910
Coeca counts -----	93 to 193	132.2	134 to 214	176.4	87 to 185	134.1
Gill raker counts -----	24 to .30	27.4	21 to 25	23.5	22 to 31	26.2
Vertebrae counts -----	66 to 68	67.0	62 to 65	63.8	-----	-----

The foregoing presentation of the results of our studies of the ova, pyloric coeca, gill rakers, and vertebrae would appear to support the belief that the Klamath and Sacramento races of king salmon possess anatomical differences of sufficient magnitude to enable careful workers to recognize individuals of the two races. Obviously, however, before one would be in a position to eliminate with reasonable certainty all individuals of other neighboring streams, studies similar to the present investigation would need be applied to the remaining forms. As already suggested, though, it seems reasonable to suppose that the chief salmon fisheries of the California littoral are supported in large measure by the fish of the Klamath and Sacramento rivers. If this be true, our data should constitute a preliminary guide for the resolution of our ocean run fish into their two great component groups.

A SHEEP-KILLING BEAR.

By L. N. LORENZEN, Grazing Examiner.

Since the bear has been made defendant in many sheep-killing cases in northern California and several reliable mountaineers have come forth to his defense, I am going to state my side of the case and the reader may draw his own conclusion as to the innocence or guilt of the bear.

In 1918 I had an occasion to visit a sheep camp near the slides of Nelson Creek and, upon my arrival at this camp in the evening, the herder informed me that an old bear with two cubs had been following the sheep for about ten days and was killing a sheep every other evening. That evening while watching the sheep feeding into the bed ground, I happened to look up on a side hill where there were about fifty head of sheep and I saw a dark brown object charge the rear of this small band. I immediately informed the herder that his pet bear had taken another sheep, whereupon we collected all the sheep dogs and a prize hound that was kept at the camp to defend the sheep from bear, and went to the scene of the kill. Here we found fresh bear tracks and fresh blood on the ground and on the brush. We turned the dogs loose, giving the hound first place, and I expected that we would soon have the bear up a tree and completely at our mercy; but not so. The hound led out with a loud bellow and long leaps, with the other dogs in hot pursuit. Soon we heard the dogs in a free for all fight among themselves, about 150 yards up the hill, and when we got there we found that they had chased the bear away from the carcass of the sheep and had it about devoured. Here our chase ended until we could get the few remaining morsels of the sheep away from the dogs and hang them in a tree out of their reach.

After the hound had satisfied himself that there was no chance for any more mutton for supper he reluctantly took up the bear track and we could hear him bellowing on the trail for about an hour. By this time it had become so dark that further chase was impossible. The only real good with which I was able to accredit the hound, aside from eating up everything around camp, was to chase the bear far enough away that it took her two days to walk to the band of sheep, which fully explains why she killed a sheep only every other day. This is a case where I was an eye witness to the killing, and I am able to cite other instances where sheep were compelled to leave the ranges on account of bear.

I do not believe that every bear kills sheep; in fact, I feel sure that they do not, but I do think that any of them can acquire the habit with a very small amount of encouragement. Careful observation has led me to believe that in many instances the bear acquires the habit of sheep killing from the careless method of disposing of sheep which die on the ranges. These sheep and others which are sick or crippled are left behind the band for any animals that wish to prey upon them. The bear, being a scavenger, eats the dead sheep and if he finds one that is not quite dead he may kill it and thus acquire his desire to kill to satisfy his ungovernable appetite for mutton.

Whenever a bear has acquired the habit of sheep killing there is but one thing for the sheep man to do if he wishes to continue using the

range, and that is to dispose of the bear. As a general rule it is not hard to distinguish a bear's kill in a band of sheep from that of coyotes or lions. The bear is a glutton and will seldom kill more than he can eat, which, as a rule, is but one sheep, while a lion or coyote will often kill as many as ten before stopping. I do not believe in taking protection away from bear but I think if the sheep men will bury all dead sheep (not burn them, because this is prohibited on account of fire danger), that the losses due to bear will be considerably less.

A SALMON'S LAMENT AT THE ESTACADA FISHWAY*

By E. A. MCGREGOR.

Oh tell me, brother *Homo*,
What you think I'd better do;
Here I am from deep salt water
With a dress of silvery blue.

I have struggled up Columbia's
Dang'rous waters set with seines,
Dodged 'twixt salmon wheels and
gill nets—
Overtaxed my meager brains.

When I reached the broad
Willamette
Something told me to turn in,
And I swam past Portland City—
Urban sewage on my skin.

Icy waters of the Clack'mas,
Fed by sparkling mossy springs,
Aroused my latent instincts,
Formed by ancient salmon kings.

Up the stream to Estacada,
O'er many a baffling falls,
I was urged forever onward,
Onward up the cascade walls.

Ever dodging wary anglers
And evading cruel spears,
I arrive at Estacada—
Rather tattered for my years.

Up the stream to Estacada
With my load of salmon eggs;
I would that I might shed my fins
And grow a pair of legs!

Some greedy corporation
Has built a mighty dam—
Eighty feet above the river—
For mercenary *Man*.

True enough, they built a
"fishway"

On the placid eastern side,
Fraught with crooks and bends
and zig-zags—

But they've not supplied a guide!

So here, at Estacada,
With my fifty-hundred eggs,
Alas, has Nature failed me
In my desp'rate need of legs.

A slave to instinct habit,
I must batter at the falls,
Which splash o'er rocky ledges
'Neath the massive concrete walls.

For Nature's built within me
A law both wise and rash:
You who'd gain the crest,
Leap where the waters splash.

Oh men of greed and money,
You've reared a lofty dam;
Your whirling turbines capture
All the kilowatts they can.

I would that you might ponder
On the ages that have passed;
Of our countless generations
I fear I'm near the last.

Long e'er you men of fortune
Had your "easy-money" dreams;
In fact, before the white man
Ever saw our western streams:

In those virgin days primeval
My silvery chinook tribe
Fairly dammed the river's current
As we swarmed from ocean tide.

My breed is doomed to perish,
Your dams obstruct my way,
Our spawning runs are baffled,
My eggs I'll never lay.

Shame, greedy men of Mammon,
Though your golden turbines turn,
You have stilled my silv'ry fam'ly
By your projects bold and stern.

Yes, I'm here at Estacada
With my fifty-hundred eggs,
After dodging seines and gill nets—
But I lack a pair of legs.

And an Alpine guide should lead
me

Up your stupid mystic route,
Which is far too steep and dizzy
For a salmon or a trout.

*The above poem may not pass the censorship of students of English and of poetry, but the idea behind it is unmistakable. It was contributed by a scientific investigator who, fortunately, is one who has some esthetic ideals that have not been obliterated by diligent search for fact.—EDITOR.

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January 12, 1924.

Through education, law enforcement and organization, the destructive ideas of taking without returning, of destroying without restoring, of using up in the present without regard for the future, are rapidly giving place to better and more unselfish views.—A. B. Brooks.

STATE FAIR EXHIBIT.

The permanent exhibit at the State Fair was remodeled and put in shape during August and proved, as usual, a great attraction during fair week. In addition to the panorama with its changing lights, the usual exhibit of live trout was made. A splendid shipment of golden trout from the Mount Whitney region proved a short-lived attraction for continued difficulty was experienced with mineralized water. The well water used in the aquaria has usually been sufficiently pure to sustain fish life but this year many valuable fish were lost. Record should here be made of the death of a very unusual eastern brook trout with a notable color pattern. This fish, nearly 20 inches in length, was marbled over its entire surface with a pattern exactly like that on the back of an eastern brook trout. In other words the color pattern of the back extended down over the sides, displacing the usual spotting.

An interesting display of illegal nets and set-lines occupied space in the second room. On one wall hung a sturgeon set-line, the kind of line largely responsible for the depletion of this valuable food fish. Overhead hung a fyke net and on the north wall was to be seen a small silken net used by the alien violator in

capturing small song-birds. The usual arrangement of enlarged photographs decorated the walls. As in the past, the educational films of the Commission were displayed twice daily in the motion picture theater. A lecturer explained the pictures and emphasized fish and game conservation.

PUBLIC SHOOTING GROUNDS— GAME REFUGE BILL.

A concerted effort is being made to gain the passage of the proposed Public Shooting Grounds—Game Refuge Bill, killed by the last Congress. With the objections of the western commissioners removed, the bill should have every chance of passage. Its greatest antagonist is no longer in Congress and additional friends are lining up for the passage of the measure. The California Fish and Game Commission has taken a definite stand in favor of the bill.

IN MEMORIAM—JOHN J. BARNETT.

As if the inexcusable number of hunting "accidents" already were not appalling enough, it remained for an unkind fate to add Deputy Fish and Game Commissioner John J. Barnett to the list early on Labor Day, when this big-hearted, faithful and fearless conservation officer was instantly killed while trailing a mule-deer near Lookout in Modoc County, where he had gone with a party of Ventura friends for his first "regular vacation" in years.

The fatal shot was fired by a close friend and county-appointee who claimed to have drawn trigger on a large deer which apparently the bullet did not strike, but found its billet in Barnett's back about 75 yards farther on. The course of the wounds indicated he had been following a fresh track and crouching to see it better in passing through the brush. As it was a soft-nosed Mauser, no deer-hunter doubts that the poor fellow was past recognizing even the nearly-crazed unfortunate who rushed up in response to his agonized cry. Such a coincidence of shooter, deer and victim in line 150 yards apart surely suggests the faith of the "Fatalists" who believe their time fixed.

"Big Jack" was buried by the Benevolent and Protective Order of Elks, in presence of his nearest associates of the Southern Division of the Fish and Game Commission, together with a host of other near and dear friends whose presence at the last tribute of respect and affection spoke more eloquently than mere words of the

high regard wherein the dead officer was held by his fellow-townsmen and co-workers. His death was a personal loss to thousands of sportsmen with whom he dealt in course of conservation duty.

Pitiful and wholly regrettable as must be any accident which snuffs out in his very physical prime, a magnificent specimen of muscular, upstanding manhood, six feet one-inch tall, broad shouldered, weighing 225 pounds, in condition, whose very appearance helped uphold the majesty of the law, the death of this veteran fish and game protector at least demonstrated that an honest and active warden

as criminally careless starting of fires is doing. Yet, for those mentally capable of careful thought, this incident of a veteran, experienced deer hunter dying before the fire of another by no means a novice, is fraught with food for earnest consideration. It is certain that the enormous increase of hunting "accidents" is becoming one of the greatest deterrents to those who otherwise would seek out deer.

Of the work of "Big Jack" Barnett, as he was affectionately known, volumes might be written concerning the wild-life welfare of Ventura County; he was born there, and knew his hills as few if any



John J. Barnett.

nowadays stands better than well in his community; and that the days when conservation enforcement lacked support are now numbered in the "Dark Ages" of southern California. Would that we also might believe that this terrible and shocking accident which has torn from wild-life work one of its most experienced protectors, might help somewhat to impress upon everybody the need of more and more caution afield in this time of ever-increasing hunting enthusiasm; for such belief might hold the hope that this good and true sportsman had not died wholly in vain. But it is hardly even a hope; for calm judgment fears that the killing of men for game will go on and on, even

others now know them. In his youth a professional ballplayer of National League ability, he was an enthusiastic and true sportsman to the last, falling a victim to his disinclination to kill any but the largest, finest deer, for which he had made this last trip to northeastern California's lava beds, seeking out the biggest and best of the "muley" bucks. He protected the game in best of faith because he had the sportsman's abiding love of it; a love that has accomplished all the practical results in its behalf that this state ever has attained. In passing, it might be said that there were few hunters and shots his equal with either rifle or shotgun. To a perfect physique he added a

true eye and an enormous, lifelong experience with the habits of wild game as well as the human nature of its biped enemies. Such men are rare, and becoming rarer in these days of advancing civilization; their loss is one impossible to replace. They know the game and its controlling conditions; would we had more of them.

Barnett's is a loss that can not even be written of by those who knew him, without tears. Particularly does it come home to those of us who can not bring ourselves to believe that this big, handsome fellow with his cheery smile will never again darken the office door, to brighten up the place a minute after with that breezy way so intimate a reminder of the great outdoors he loved so well and served so faithfully.

L. HEDDERLY.

ALBACORE FISHERY WORRIES CANNERYMEN.

Cannerymen of southern California were greatly disturbed during the latter part of July because of the failure of albacore to put in an appearance in their usual habitat about the Channel Islands. Five hundred fishing boats scoured the sea but failed to find fish. As a consequence the price jumped from \$120, that paid last year, to \$220 and even \$300 per ton. Even with such prices offered, the canneries, as well as the fishermen's fleet, remained idle.

On August 1, large catches were reported in the vicinity of Todas Santos Island, off the Lower California coast. Albacore were reported as close in shore and very hungry. Although some improvement was evident later, yet the season proved a very poor one.

On August 27, near the end of the season, the Curtis Corporation of Long Beach paid fishermen \$400 per ton, the highest price which has ever been paid for "white meat" albacore. Moreover, this has been the shortest season in the history of the industry. The pack this year it is estimated will amount to about 185,000 cases as compared with last year's total of 300,000 cases. Undoubtedly this scarcity will result in an increased market price for the canned product.

This decreased run of tuna adds one more problem in the investigation being made by the Fish and Game Commission to determine whether such a scarcity of fish is caused by actual depletion or by natural fluctuation.

COURT ORDERS SCREENS INSTALLED.

Because of its possible bearing on the application of the Electro-Metals Company, now pending before the Department of Public Works, Division of Water Rights, for certain water and power rights on the Klamath River, unusual interest attaches to the permanent restraining order issued by Judge C. J. Luttrell of the Superior Court of Siskiyou County, July 17th. This order, which directed the Parker Company, owners of large holdings of irrigated lands in Scott Valley, to refrain from using their canals and ditches until properly and adequately supplied with screens, upholds the right of the state to compel owners of land to install screens which will prevent the fish from being carried out onto the land. The decision is encouraging as such screening would be useless should the proposed dam be built near Orleans.

This proposed project of the Electro-Metals Company is one which challenges the interest of all California anglers since their object is the construction of a dam 250 feet high, 80 miles from the mouth of the Klamath River, the last stronghold of the king salmon, the best run of trout, and the most important source of supply of trout eggs. The attempt to preserve these great natural resources is not in any sense a move to hinder power development in California. It is stated on good authority that not only is there no immediate need for further power development on the Klamath River, but that it will be many years before such need exists.

SAVE THE KLAMATH SALMON AND TROUT.

Typical of the letters being received by the commission regarding the proposed construction by the Electro-Metals Company of a 250-foot dam 80 miles above the mouth of the Klamath River, which would form an impassable barrier to the last great run of king salmon and sea-run trout in the state, is the following from a California sportsman:

"I never enjoyed fishing any place more than on the Klamath River. The fish are too hard for the 'greenhorn' to catch. They are large and fine and good fighters, and the Klamath is a swift-running river. If the Electro-Metals Company is allowed to put in a dam at "Happy Camp" on the Klamath, the river will surely be ruined for all kinds of fishing. The run of salmon and steelhead will be shut out and the stream rendered useless for propagating these

fish. This it would be a shame to allow, for California is a paradise for sportsmen and the fish and game should be preserved. The run of salmon and steelhead in the Klamath River is a great asset to California. The loss of it could never be recovered, or even repaired. Therefore, in this particular instance I believe the state can not afford to allow the construction of this dam. I am glad to know the Fish and Game Commission is trying to defeat this proposal and I certainly hope it may be prevented."—R. F. COOKE, Los Angeles, Cal.

THE ALIEN VIOLATOR AND EDUCATION.

In California the majority of violations of the game laws are credited to aliens, of whom a large proportion are Italians. It is a notable fact that they are particularly troublesome about taking all kinds of birds, the song and insectivorous species as well as the game birds and small animals taken out of season. Many nets and other illegal devices for snaring small birds have been confiscated by deputies.

These violations are better understood when it is known that Italian game laws differ radically from those of this country. It is small wonder that the Italian laborer looks upon his hunting permit as a blanket affair covering everything, when in his own country all birds, even to the smallest varieties and those of most value to agriculture, either had a long open season or no protection whatever. It is also true that most of the devices used for catching birds are permitted in Italy, even to the use of decoys in nets during daylight hours.

In view of these facts the most logical and fair remedy, it would seem, lies in a campaign of education designed to inform such violators of the differences in our game laws and to impress them with the fact that our laws will be enforced. Teach them the value of birds to agriculture, provide signs and notices printed in their own language explaining specifically what a hunting license covers and when seasons open and close. Such a campaign, thoroughly and persistently followed, may result in turning many of this class of violators into active conservationists. The cause of good citizenship will thereby be advanced also. The Commission plans to enlist Americanization agencies in such a campaign.

CONSERVATION SENTIMENT IS GROWING.

Heretofore drainage projects have been put through with no consideration being given as to the effect upon natural re-

sources. If land could be drained and turned into farm land, it was considered sufficient cause for destroying breeding grounds of fish or game. That the time has come when the value of such areas as breeding grounds for wild life is actually considered and compared with its agricultural value is evident from recent legislation in the middle west and from the storm of protest which has arisen over the proposed Winneshiek Bottoms Drainage Project. The area proposed to be drained lies along the Mississippi River between Lake Pepin, Minnesota, and Rock Island, Illinois. The plan is to dredge and dyke the main channel of the river so that all the rest of the bottom land from bluff to bluff will be thereby made dry land and thus suitable for farming purposes.

An agricultural expert of the Iowa Experiment Station opposes the project on the grounds that it is economically unjustifiable on account of the prohibitive cost, the small value of the farm land, the danger of overflows and the resultant destruction of the breeding places of waterfowl and fur-bearing animals, and the spawning grounds of fish, as well as the recreational features of this section.

The Isaak Walton League points out that this area is the spawning grounds for black bass and all of the warm water game and food fishes. It is called the greatest natural hatchery for game fishes in the whole world.

An investigator sent out by the United States Biological Survey reports that the whole area is an excellent resort for waterfowl of all kinds and that the muskrats are a resource of considerable value. The various lakes and sloughs form a wonderful refuge for fish and supply suitable spawning grounds. During the year 1921, the United States Bureau of Fisheries reclaimed 23,607,000 fishes from this general area. The Bureau of Fisheries which has endeavored to maintain the supply of fish in this part of the Mississippi River recognizes that all of their work would be nullified by this drainage project. Local sentiment also appears to be strongly opposed.

Secretary Hoover, when interviewed on the subject, is quoted as saying, "Until the people care and let their state governments and the national government know that they do care, it is useless to attempt to get anywhere with pollution or any outdoor American legislation."

It is certainly encouraging to see such strong opposition to a scheme which undoubtedly would seriously affect the fish and game resources of several states.

**CALIFORNIA ASKED TO INTRODUCE
THE AMERICAN WOODCOCK.**

The Bulletin of the American Game Protective Association, through the columns of *Field and Stream*, makes the suggestion to the various game commissions of the Pacific coast that they introduce the American woodcock from eastern states, where it is still possible to secure a supply. Conditions on this coast, from British Columbia to northern California,

are said to be ideal for this highly prized game bird.

Many experiments in introduction of exotic species have been tried, as for instance, that of the California quail into Chile, the importation of the Hungarian partridge into many western localities in Canada and the United States, and the popular Chinese pheasant into several states. Where such introductions do not interfere with native species, they often



FIG. 35. "I got him!" That was the exclamation heard from Mrs. John Edwin Hogg after a lone Canada "honker" winged his way over the marsh and she had fired one shot at him with a 20-gage shotgun. Photograph by John Edwin Hogg.

prove a valuable contribution to the game resources, furnishing additional sport and, in some cases, being of possible help to native species by lessening the concentration of hunting upon them.

Where, however, has a migratory shore bird been successfully introduced? This would constitute a brand new experiment and one fraught with unknown difficulties. Then too, it is well to remember in this connection that all such introductions have greatly increased the problem of game conservation and in some cases species have proved dangerous pests. In such an undertaking, western states should proceed with caution and thoroughly investigate the problem before launching such a project.

OREGON HAS NEW COMMISSION.

During June, Governor Pierce of Oregon made a complete change in the Game Commission. The Governor's statement was as follows:

"I am making a change in the game commission of Oregon because of the lack of harmony now apparent in that body and because of the strong indication of political manipulation by certain men now connected with the administration of game affairs. The future of game in the state of Oregon is far too important a matter to be handed about politically.

Three hundred thousand dollars annually as paid by the sportsmen of the state is far too large a sum to be jeopardized by disconcerted effort. The preservation of wild life of the state is the paramount consideration of the commission.

Because of these considerations I deem it advisable at this time to make changes in the personnel. The governor is responsible for the commission and therefore to the sportsmen of Oregon for the conduct of game affairs.

With the deep realization of that responsibility I have selected as new members of the commission, men of the highest type, all of them successful and responsible business men and all interested in the conduct of game affairs.

It is not the intention of the executive to dictate to the new commission or to meddle in any way with its affairs. It is not the purpose of this office, as has been suggested, to throw the commission into politics.

Game affairs are to be left entirely to the new commission, a body in which the governor has the utmost of confidence and a body which will meet its obligations with the greatest advantage to the wild life of the state."

THE CROW AND GAME.

Recent investigations by Dr. B. H. Warren along the eastern shore of Virginia has brought forth a mass of evidence showing that great damage to game re-

sults from the egg-destroying propensities of the crow. A number of islands were visited and in each instance thousands of eggs of the game and useful birds were found destroyed by crows as well as a large number of young birds. On islands where human habitations were abundant many eggs of chickens and wild ducks were found destroyed.

Dr. Warren states that on Cedar Island, where a colony of about forty crows were found, five nests were discovered. "In an hour and twenty minutes, under these five nests and within a radius of 150 yards, I found fully 2500 egg shells of the game and nongame birds which had been eaten by crows."

"At Pammer's Point there stands a large pine tree, much higher than any other tree about it. This is evidently a feeding station for crows. There were two crows' nests within a hundred or a hundred and fifty yards of this tree. One of these nests contained five young, which were of the common American crow species, and the other containing one young, was that of the fish crow. Under the large tree referred to, near the nests, there were at least 225 empty egg shells; many egg shell fragments about the tree were not counted. This mass of egg shells consisted chiefly of those of clapper rails, green herons, laughing gulls, and a few eggs of barnyard fowls."

The islands visited are very largely owned and controlled by sportsmen's clubs and consequently the investigation should stir up interest in the control of this pest. Fortunately, in California the crow has not developed such unusual egg-eating habits, although it is well known that poultrymen in the vicinity of Petaluma sometimes are troubled by crows. Such evidence as presented by this investigation in Virginia should make California alert to examine the nests of California crows for similar evidence that we may be forewarned as to the actual effect upon other birds.

JAIL SENTENCE FOR VIOLATOR.

An item in the *Catalina Islander* of June 27, states that having been found technically guilty of violating section 636 of the Penal Code (relating to nets), Captain Nick Skomereza, owner of the commercial fishing launch, *Daylight of Seattle*, San Pedro, was sentenced to 100 days in the county jail. Captain Skomereza, who was given a suspended sentence by the court a year ago, admits that the entire catch of fish—18 tons of barracuda—said to have been illegally taken near Seal Rocks; May 7, was sold

and the proceeds received by him and divided among the crew. Although it seems that the vessel left San Pedro harbor without reporting a change of officers, Captain Skomereza maintains that he was not on board the vessel when the fish were taken, and on that ground his counsel announced that the case would be appealed to the superior court. The arresting officers were unable to locate any of the fishermen who manned the boat at the time the fish were taken. Captain Nidever of the Fish and Game Commission appeared in court against the defendant.

tection similar to those provided for the Toyon berry.

CONNECTICUT BOARD TO INVESTIGATE SHAD DEPLETION.

For an investigation into the causes of the alarming depletion of shad in the Connecticut River, the legislature of that state has appropriated \$10,000. The investigation will be conducted during the summers of 1923 and 1924 under the direction of the Connecticut State Board of Fisheries and Game and a staff of six eminent biologists, including Dr. J. E.



FIG. 36. Canada geese, photographed at former State Game Farm at Hayward. The Canada goose is the largest and the only species of goose which nests in California. Photograph by H. C. Bryant.

GAME LAWS FOR PLANTS.

More and more as the years go by it is becoming necessary to protect, by law, rare or much sought-after native plants and shrubs. Vermont had its problem in the collection of living plants and ferns by nurserymen for commercial sale. Connecticut has the problem of being easy of access by automobile from New York and Boston and of having its woods and hills stripped by motorists of the state flower, the mountain laurel, and of the exquisite trailing arbutus. Because of the destruction wrought upon these and other plants, statutes have been enacted to protect them. Maximum penalties range from \$20 to \$100 or 12 months of imprisonment, or both. Unless there is a decrease in the heedless gathering of many of our California wild flowers and shrubs, measures will have to be taken for their pro-

tection similar to those provided for the Toyon berry.

Blair of Stanford University, has been engaged for the work. The shad, a popular fish in eastern markets, has decreased very rapidly since 1919 as evidenced by the decreasing commercial catch and the increasing difficulty of obtaining eggs for artificial propagation. The experiments being undertaken, will cover studies in methods of catching the fish for artificial spawning; life history of the shad including food habits, migration periods, and other phases; various problems of pathology such as parasitism and enemies of larval and young shad; a close observation of ecological conditions, especially the pollution of tributary streams in which the shad spawn; tagging experiments of adults to obtain information on successive migrations and the feasibility of providing greater security to young shad by hold-

ing in specially prepared ponds a part of the artificially hatched fish.

The shad was the first species of fish introduced into California by the Fish and Game Commission (plantings were made in 1871 and 1873) and it became very abundant here. While shad have increased enormously in California, the supply has been greatly depleted along the Atlantic coast. In 1916, Connecticut and Massachusetts sought to obtain shad eggs from the California Commission for their hatcheries in order that they might restock their waters. The California Commission undertook to furnish the desired eggs, expecting to gather them in connection with an investigation of the spawning places of shad and experiments in shad culture. However, the season proved to be such an unfavorable one that it was impossible to gather enough eggs at any one time for shipment east. They did succeed in collecting enough eggs to hatch 872,000 fry which were planted in the Feather River with good results.

WILL ATTEMPT DOMESTICATION OF WILD TURKEY.

Live specimens of the beautiful Honduras spotted turkey, a fine upland game bird, native to a section of Yucatan, Honduras and Guatemala, is the object of an expedition by the Biological Survey of the Department of Agriculture to Central America. According to an editorial note in *Forest and Stream*, June, 1923, the survey intends to undertake experiments in propagating and domesticating these turkeys on an island off the coast of Georgia. The domestication of this species, which is somewhat smaller than our own domesticated turkey, has never been attempted.

THE NATION'S GAME SUPPLY.

Attention is directed to the enormous value of the nation's game supply by the American Game Protective Association. Although monetary values do not compare with the benefits yielded in pleasure, health, personal physical and mental development, self-reliance and skill in the use of firearms, all of which accompany hunting, yet the "dollars and cents" value to hunters is worth consideration. Dr. E. W. Nelson, chief of the United States Bureau of Biological Survey, is quoted from an article in the *Scientific Monthly* as estimating the game of the country, capitalized on a 6 per cent basis, as amounting to \$1,000,000,000. Since the licensed and private hunters in the United States are estimated to number about

7,000,000, this would give each sportsman a share in the capital investment of nearly \$150. Thus, says Dr. Nelson, "The conservation of wild animals and birds is not a mere fad, indulged in by those who have only a sentimental interest in the subject."

CONSERVING THE FUR SUPPLY.

Resolutions were drawn up at the recent International Fur Convention and Exposition at New York, recommending, for the first time in the history of the fur trade, the formation of a national organization which should hold a yearly convention in that city. The Biological Survey of the United States Department of Agriculture has been greatly interested in the fur industry from the standpoint of the conservation of wild life, and F. G. Ashbrook, one of its representatives, addressed the convention on the work of the Survey relating to fur-bearing animals.

"The fur industry," said Mr. Ashbrook, "employs many thousands of men and women who make their living from furs and who in turn contribute to the comfort of a vast number of people. Ever since the world began people have worn furs and they will probably continue to do so indefinitely. The sources of supply of fur-bearing animals should be assured, however, if the fur trade is to maintain its position among other large industries. We do not need more laws but we need better laws and a stricter enforcement of them.

"The Biological Survey believes that fur farming should be encouraged. At present the majority of fur farmers are raising silver foxes. There are at least 15,000 silver foxes in captivity and the investment in the business exceeds \$8,000,000.

"The bureau also believes that to aid conservation, areas which have been depleted of fur bearers should be closed completely for several years, and should be restocked, just as public and private waters are stocked with fish, or game preserves with game.

"Fur laws should be made uniform in all states where similar climatic conditions prevail. Regulation by law of the open season and intelligent trapping should help materially to insure the source and continued supply of fur bearers. Legislation should also require that figures be furnished to show the numbers of the various pelts taken annually in different states."

The fur exposition, which was held in Madison Square Garden, was staged in

an arctic setting composed of igloos, totem poles, snow and icebergs. Living models were posed to show the fur costumes of fourteen different periods in the world's history. Processes in preparing furs and making them up into garments were shown, and a style show was staged. The exposition was open only to those engaged in the fur trade, but there was a strong sentiment on the part of those in charge that another time it should be open to the general public.

WOOD DUCK HUNTING PROHIBITED.

Wood ducks may not be hunted in Minnesota or in any other state at any season, according to the Biological Survey, United States Department of Agriculture, which administers the migratory-bird treaty act. This is a federal law under which the hunting, killing, or possessing of wood ducks is prohibited at all times throughout the United States and by treaty throughout Canada also. This game law, having been upheld by the



FIG. 37. Sting ray, taken by G. A. Clark in Elkhorn Slough, summer, 1920. It weighed 64 pounds and gave birth to seven young soon after capture. Photograph by G. A. Clark.

United States Supreme Court, makes inoperative the amendment to the game laws of Minnesota, passed at the last session of the state legislature, providing an open season on wood ducks. Thus, hunters will not be allowed to exercise the privilege accorded them by the state law, and persons found hunting, killing, or possessing wood ducks at any time, will be subject to prosecution in the federal courts.

HUMAN CARELESSNESS EXACTS HEAVY FOREST FIRE TOLL.

Over 70 per cent of the 610 fires that have occurred up to August 20 this year in the National Forests of California were man-caused, according to the United States Forest Service. These fires burned over 72,000 acres of government land, and 34,000 acres of private property within and adjacent to the federal forests. Out of a total of 124 fires in the Angeles, Santa Barbara and Cleveland national forests of southern California, all but six were due to human carelessness, largely that of smokers, campers and sportsmen. Fires on the Santa Barbara National Forest, set by the carelessness of campers and by incendiaries, have burned over 60,000 acres of chaparral and timber-covered mountain slopes which were of inestimable value for watershed protection purposes. Seventy-four convictions for carelessness with fire in the woods have been secured by the Forest Service to date; the fines ranging from \$50 to \$500, with jail sentences in some of the more flagrant cases.

Think of what such carelessness means to fish and game!

SIGNS AND SIMPLETONS.

By RANGER BILL, U. S. Forest Service.

"Did you ever notice how many people there are who seem to have a weak cog somewheres in their make-up?" said Ranger Bill as he threw a bunch of new enamel signs that had been shot full of holes into the woodshed. "Mind you I don't claim such folks are what you would call 'foolish,' but they sure must lack good sense to pull some of the tricks they do. Of course sometimes it's due to thoughtlessness, but pure cussedness would be more like it, I reckon, in a good many cases.

"Who'm I alluding to? Why, just them folks, big and small, that go around shooting up signs and writing their names on rocks and trees and buildings and any old handy place. We get a lot of them up here on the National Forests in the summer time—natives and city people and

'dudes' out on a vacation, who either think it's smart to make a pepper box out of a sign or else want to leave a monument to themselves by scribbling all over the landscape. You know that old saying about 'Fools names * * * '?

"You think I'm putting it too strong? Well I don't. If you could trade places with me for a season and see some of the stunts of these vandals, you'd know why I get hot under the 'Stetson. Let's look at this business with common sense. Here's the Forest Service and the automobile associations of the state spending a lot of good money each year to put up fine enamel signs so that our own folks and all the people who visit California can tour around in the mountains without getting lost. Then along comes some smart Aleck with a gun and—Bang! Bang!—another sign is shot full of holes and ready for the ash heap. And it isn't only one, but thousands of them that get made into a sieve that-a-way. Seems like these fellows would appreciate rather than depreciate a sign, and think a bit about the people that's coming after. Every time a sign is badly defaced a new one has to be made and put up, and that means more money and work. Once in a while we catch these birds, and the way the Judge usually hands it to them sure does a man's heart good. If there is anyone that ought to get it, and get it good, it's these sign poachers.

"Now look at those autograph sharks and some of their artistic work. Why, only last week I found the name of a professor of one of our big state universities scribbled over the newly painted door of a lookout station up at 10,000 feet. What do you suppose his idea was? If he wanted me to know he'd called why didn't he leave a card or write on a piece of paper? If I can tie-in with him I'm sure going to make him back-track up there and scrub that name off with sapolio. Just you stop and take a peek at that big Forest Service sign down at the forks of the road. I only put it up this spring, and now you'll find a regular telephone directory scratched all over its face. No, sir, it ain't th' kids that pull all this stuff, but real grown-up men and women who ought to know enough to respect other people's property.

"A fellow was telling me the other day that the temples in Egypt have all kinds of names and pictures that senseless people scratched on the stones three or four thousand years ago. I always thought we'd kind of advanced in civilization since then, but it 'pears like we've got simpletons in these days same as they had back in King Tut's time."

FACTS OF CURRENT INTEREST.

A 22-inch Loch Leven trout was caught from the Sentinel Bridge in Yosemite Village on June 29th and was on exhibition during that day in the office of the park superintendent. The Loch Leven is one of the introduced fish which, like the brown and eastern brook trout, thrives in the warmer, slower-moving waters of the lower elevations, whereas the native rainbow chooses the rushing mountain streams of a granite-walled canyon.



The season of 1923 was the greatest in the history of the Hatchery Department, the largest number of trout being planted in the history of the Commission. The total approximated 31,470,000.



The salmon season has been a poor one, the catch indicating depletion. The take will probably amount to less than half of that for 1919. Reduced catches have been made yearly.



The sardine industry has recuperated and the catch will be close to normal.



Hunting accidents have again been numerous, one of them claiming an efficient deputy of the Commission.



The duck season opened auspiciously on October 1st with birds abundant and many hunters in the field.



The Fish and Game Commission is actively fighting the proposal to build a 250-foot dam near the mouth of the Klamath River. To win the fight means the saving of the last good run of king salmon and of sea-run trout in the state.



Concentrated hunting of mule deer in Modoc County was again reported during the deer season. Sentiment favors increased protection for the large deer of the northeastern section of the state.

HATCHERY NOTES.

W. H. SHEBLEY, Editor.

TROUT EGGS TO BE IMPORTED.

Arrangements are again being made this year to trade the New Jersey Fish and Game Commission 1,000,000 Loch Leven trout eggs for 1,000,000 eastern brook trout eggs. This arrangement, made last year, was instrumental in furnishing our streams with a splendid supply of pure stock eastern brook directly from eastern streams.

screens in keeping fish out of irrigation ditches. The installation, on the Alta Canal near Dinuba, Fresno County, of an improved type of electric screen patented by Mr. H. T. Burkey, has afforded the first opportunity in California to test its real value. The report of Deputy E. W. Smalley, recently submitted, gives the results of observations made by himself and others on the Alta



Fig. 38. Electric fish stop installed in Alta ditch near Dinuba. Investigations showed that this electrical apparatus did not successfully screen the fish from the ditch. Photograph by A. E. Culver.

ATTEMPTS MADE TO SECURE NEW TROUT.

An attempt is being made to secure a supply of Sunapee trout from the Massachusetts Fish and Game Commission. The Sunapee trout is a bright colored trout originally found only in Sunapee Lake, New Hampshire and Flood Pond, near Ellsworth, Maine. Due to fishcultural operations, however, it has been introduced into a number of other lakes. In its native habitat it does not take the fly readily but makes up for this disadvantage by its gaminess when caught by trolling. Fish have been known to weigh as high as 15 to 20 pounds. It is also said to be especially hardy and easy to propagate.

ELECTRIC FISH STOP DOES NOT STOP FISH.

There has been a great deal of discussion as to the efficacy of electric fish

system below the electric stop at Waho-ka Lake, covering a period of three months and ranging from the stop at the lake to points south and west of Traver and to points south and east of Orosi.

It appears that early in the season (April 20th to about the middle of June), owing to high waters and the amount of water going through the electric fish stop, it was almost impossible to get definite evidence of fish life. However, observations made on June 21st, which very nearly covered the Alta system, showed several thousand small fish including bass, pike, suckers and river herring in a lateral south of Traver, and numbers ranging from a few to several hundred of these same varieties were found in various checks around Dinuba and Momson. On this date also, a carp about 15 inches in length was seen to go through the stop. About 5 feet below the stop it came to the surface, apparently injured, but less than

100 feet below the stop it was seen to swim away and seemed to have entirely recovered from the shock. By July 8th many small fish were found in a number of the extreme lower laterals of the Alta system south of Traver and Dinuba. The last observation was made on July 18th and up to that time evidence of fish life had been found in nearly every place investigated and hundreds of small dead fish were found at the abutments of the screen and many larger ones ranging from 6 to 16 inches, of the several species mentioned, were found just below the screen. Many of the dead fish found a quarter of a mile down the ditch from the screen, showed injuries from contact with the

Yosemite and Sequoia national parks has been unusually good this season. The Merced River is said to have furnished better fishing this year than ever before and skilled anglers were successful in taking large fish.

In June the Commission planted 95,000 rainbow trout, received from the Hammond Hatchery, in various streams of Sequoia Park and in July, 90,000 steelhead trout arrived and were planted in Marble Fork, Paradise and Deer creeks. Fifty thousand trout fry were also planted in streams within General Grant National Park. Yosemite's first shipment of eastern brook and rainbow trout numbered 200,000.



FIG. 39. Large black bass taken below electric fish stop in Alta ditch, along with other specimens, showing that this electric fish stop is not effectively screening the ditch. Photograph by A. E. Culver.

electrodes. Late in the season, bass ranging from 8 to 12 inches long were seen below the check at the head of the Reedley Canal and one 18 inches long was taken in a seine with a number of smaller ones. Bass were also seen at the head of the Traver Canal and a great many in the branch south of the Dinuba Kingsburg Highway. The accompanying photograph of a bass taken below the fish stop is evidence of the size of fish which can successfully pass this electric stop.

FISH PLANTED BY THE COMMISSION FURNISH SPORT IN NATIONAL PARKS.

Bulletins of the National Park Service report that fishing in the streams of

TROUT EGGS HATCHED IN GRAVEL.

The new method of hatching trout and salmon eggs in gravel seems to promise advantages of plantings in the headwaters of streams and the tributaries of lakes inaccessible with fry or fingerlings, of making distributions over greater water areas and so of materially reducing hatchery expenses and distribution costs. In the U. S. Bureau of Fisheries document, "Propagation and Distribution of food fishes, 1922," Glenn C. Leach, of the Division of Pisciculture, reports the general results of experiments conducted by various stations of the Bureau in which the eggs were placed in gravel in hatching troughs, in open-air rearing ponds and in creek beds. In cases where the eggs were protected from frost and

where there was a good circulation of water, good hatches were secured in nearly every instance.

Since the gravel beds of gently flowing streams and places where seepage or substream flow is present, are the spawning places naturally sought by trout and salmon, it is not surprising that practically perfect results are secured under such conditions and that the fry so hatched are exceptionally vigorous and fitted to survive.

It can not be expected that this method will prove of great value in hatchery operations in general, especially on a large scale, but its value in stocking suitable waters with eyed eggs may supplant the planting of fry and fingerlings in such places.

L. Ripple, Superintendent of the State Fish Hatchery at Bayfield, Wisconsin. Reliable data on what percentage of planted trout reach maturity, whether it is better to plant fry or fingerlings, and what is a good average growth in cultivated water is the object in view. The experiments are being conducted in a large pond in which conditions affecting trout approximate those of a stream, and where an absolute check on the trout planted can be obtained. In the fall of 1921 there were planted in this pond 2000 small fingerlings. At the end of a year, the pond was drained and the yearling trout were carefully counted. A total of 1321 trout averaging seven and one-half inches in length had survived. The minimum and maximum lengths were six and nine



FIG. 40. Type of screen being installed by the Los Angeles Aqueduct at Fish Springs, Inyo County. Photograph by A. E. Culver.

A successful planting by this method was made in Yosemite this past summer. A shipment of eggs from the United States Bureau of Fisheries hatchery in Yellowstone National Park was planted in the stream near Ottoway Lake. Later investigation by Ranger Skelton showed a large percentage of eggs hatched. Plenty of egg shells and some newly hatched fry were found.

WHAT PERCENTAGE OF TROUT REACH MATURITY?

An experiment with trout fry and fingerling to determine two much mooted questions among fishculturists is in progress under the direction of Mr. Robert

inches respectively. This season the experiment is to be repeated with the substitution of fry for the fingerlings. The results will be awaited with interest as an aid in solving some hitherto unsolved problems of fishculture.

FISH DISTRIBUTION, 1923.

Previous to September 28, the Fish and Game Commission had planted in the various streams of the state approximately 9,983,000 rainbow trout fry, 5,300,000 Loch Leven, 8,667,000 steelhead, 3,480,000 eastern brook, 1,325,000 brown, 2,530,000 large lake, 95,000 cutthroat, 90,000 Mackinaw, and some 500,000 fry yet remained to be planted.

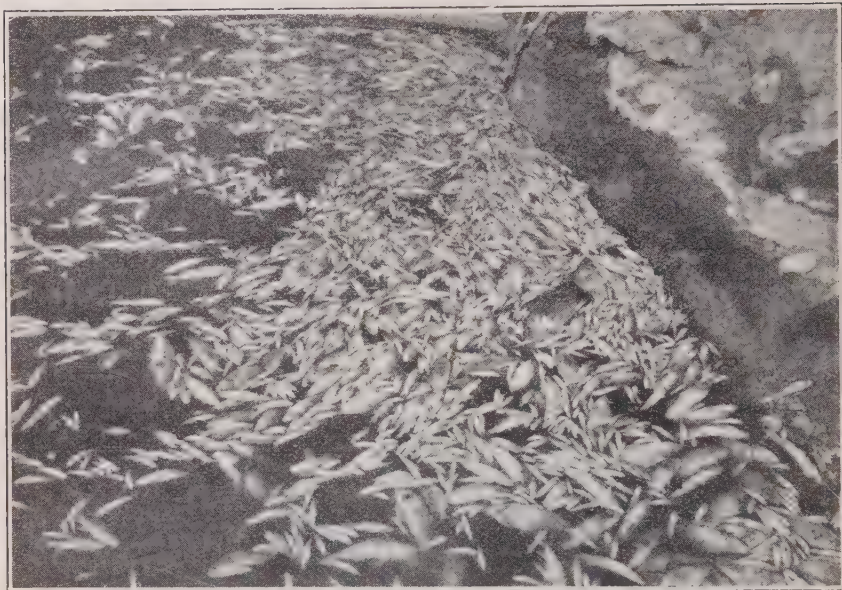


FIG. 41. Typical of what happens when an irrigation ditch is not successfully screened. More than 2100 sunfish are shown in the picture. This death toll was due to ineffective screening in Butte County. Photograph by A. E. Culver.

COMMERCIAL FISHERY NOTES.

N. B. SCOFIELD, Editor.

WHO ARE THE CONSERVATIONISTS?

It seems to be the general impression among sportsmen that if the fish are to be saved from extermination by the commercial interests the sportsmen are the ones who will have to act. Their idea of conservation it appears is not to curb in any way the sportsmen themselves but to curb only those who catch and deal in fish as a livelihood. If we examine our laws which have been passed for the purpose of conserving our food fish it will be found that the sportsmen in nearly every instance have been specially favored. A good many kinds of fish have been taken off the commercial list and their sale prohibited. They may be taken only by angling and in several instances the angler is not restricted by a bag limit. If a closed season is established for the protection of an important food fish the sportsman is given the special privilege of fishing through the closed season.

Those who have had experience in enforcing fish and game laws know that the only way to make a closed season really effective is to prohibit the possession of the fish, bird or other animal during the

season it is to be protected. The three salmon or five striped bass of any size which may be taken by any one for sport each day during the closed seasons for these fish make it difficult and in some instances well nigh impossible to enforce the ban against commercial fishing during the closed time or to enforce the law against the sale of striped bass under three pounds in weight. Other special privileges which sportsmen anglers enjoy are the areas and districts which are set aside for angling and closed to commercial fishing. When these closed areas are set down within a rich commercial fishing district such as the closed area at Catalina Island and the space of 750 feet about pleasure piers, jetties and breakwaters it not only makes the fisheries patrol by the Fish and Game Commission very difficult but it tends to keep alive the antagonism which usually exists between sport and commercial interests. Most of this antagonism is the result of sportsman-made laws and the lack of knowledge on the part of the sportsmen of the commercial fishing methods and conditions. Certainly one can not attend

several sessions of the state legislature and observe the passage or defeat of fish and game conservation measures and believe that sportsmen hold any monopoly on the desire for fish and game conservation.

Take for example the last session of the legislature. In the measures introduced or proposed there was ever present, on the part of sportsmen, the tendency to loosen up on the conservation laws where their pleasure was concerned. The greatly increased drain on our trout and our deer, caused by the building of good roads and the universal use of the automobile, make it advisable to cut down on the trout seasons and on the bag limits for both trout and deer. It is also urgent that the winter fishing for steelhead be stopped, for good trout fishing in our coast streams is largely dependent on preserving the large spawning steelheads. What was done? The sportsmen would not be satisfied with one buck a season, they wanted their two. The anglers did not want trout fishing restricted. Instead they wanted the daily bag limit increased and they did get the limit raised to thirty-five per day, but fortunately the bill was not signed. There was little chance to get winter steelhead fishing stopped. The tendency to loosen upon the game laws reached its climax in the serious proposal to permit the limited killing of mountain sheep by those who would be willing and able to pay a large fee. This proposal developed considerable opposition and the bill was not pushed. Such a bill has been up before and will come up again but will be defeated, more because it will be giving a special privilege to a few than because it is likely to exterminate the small remnant of our once abundant mountain sheep.

Legislation.

How did the commercial fishing measures fare? There were only two measures of prime importance from the standpoint of conservation. One was a measure which would prohibit the use of drag nets in southern California waters. It was believed the fishery would produce more if the drag net, which is very destructive to young halibut, was eliminated. The other was a measure which would give additional protection to salmon, shad and striped bass.

These measures were supported by most of the commercial fishing interests affected in spite of the fact that it meant a financial loss to them. They are for conservation for they have money invested in their business and they want

their business to be permanent and continuous. It is necessary, of course, to convince the commercial fisherman or dealer that a species of fish needs protection or that the measures proposed for its protection are equitable and necessary. In the above instances this was not hard to do, except in the case of the striped bass. The evidences of overfishing are not as plain in the case of the striped bass as in that of the halibut, shad and salmon. Most of the angling clubs in the San Francisco bay and river regions believed that the striped bass needed radical restrictive measures passed for their protection. None of the measures proposed by them would restrict the angler in any way but most of the bills introduced would prohibit the use of nets for a period of five years. Such a measure was not necessary even if it could be put into practice. Due to a lack of knowledge of the fisheries, sportsmen could not see that if netting for striped bass were stopped that netting for salmon and shad in the same waters must stop at the same time. At first the radicals would not compromise but left the Fish and Game Commission, the California Fish, Game and Forest Protective League and the representatives of the commercial interests to work out measures which they considered equitable, less radical and in a large measure adequate. The measures thus adopted were finally passed by the legislature. The measures did not become effective in their entirety for the reason that the Governor failed to sign the bill which amended the law relating to the fish and game districts of the state. The principal reason for the failure of this bill was that it had many changes in the districts to please the sportsmen of local communities which were objectionable to sportsmen in other parts of the state.

Due to the failure of the "District Bill" to pass, netting was not stopped in the Sacramento River between Sacramento and Colusa, as intended, but netting was stopped above Colusa which is a very great protection to salmon as it eliminates the bar seining which was so destructive to the salmon which are virtually on their spawning grounds. The Sacramento River was closed to salmon netting during the months of June and July and the summer closed time for shad and striped bass begins now fifteen days earlier. Sea trolling for salmon is materially restricted. The seasons for salmon sea trolling in northern California waters are not what was agreed upon, due to the failure of the districting bill to become a law, but the salmon will not suffer on account of it.

The bill which prohibited the use of drag nets in southern California waters was passed and received the signature of the Governor. Due to the failure of the districting bill, the prohibition against drag nets applies to Santa Barbara County waters as was not the intention. An attempt is being made to remedy this by test cases in court.

The important conservation measures passed at the last session of the legislature were commercial fisheries measures and they were passed with the aid of the commercial fisheries interests. On the sport side of the ledger there were no conservation measures of importance passed and the important measures which were proposed, failed to pass for the reason that they were opposed by sportsmen.

Another bill which failed to meet with the approval of the Governor was one which would have permitted any reduction plant to use sardines without limit as to amount during four months of the year. This bill was originally introduced at the request of sardine canners who would reduce the amount of sardines a canner would be allowed to use for reduction purposes. At the request of the Fish and Game Commission changes were made in the bill so as to make the law easier of enforcement. When the bill came up in committee those who were anxious to obtain more and cheaper fish meal for poultry feed and fertilizer, those interested in reduction plants and machinery, as well as sardine canners who would make a profit on the side by means of their reduction plant, succeeded in getting the bill amended so that its meaning was quite different from what was originally intended. Many ingenious arguments were brought out in the talks before the committees. The best points brought out by those who would use sardines for reduction purposes were:

Sardines on the coast of California are very plentiful and in spite of the large catch of the past few years are more abundant now than they were ever known to be. It has never been proven that members of the herring family, to which the sardine belongs, have ever been exhausted at any place by overfishing. If there is any danger of overfishing here in California, the investigations being carried on by the Fish and Game Commission will show when they are being subjected to too great a strain and the fishing for reduction purposes can be restricted or stopped.

The better arguments in opposition were:

While there have been periods of scarcity in the past and sardines are apparently more plentiful now than for several years past, that is no sign they will continue to be abundant. Fish like the sardine are subject to great natural fluctuations in abundance and they probably will become as scarce again as they were in 1913, even if they are not subjected to heavy fishing. Any fishery can be depleted if great quantities of the fish are caught. If the menhaden, which is caught on our Atlantic coast in quantities as high as six hundred million pounds a year, does not show depletion, it is because no system of records or of investigations have been carried out which would show depletion, if it were occurring. Even if our sardine can stand much heavier fishing than it is being subjected to now, there is danger that a great reduction industry will gain a foothold which can not be shaken loose when depletion is shown, and our sardine industry, which should be of the most value because per ton of fish it would give employment to more people and the finished product would be of greater value, would be jeopardized. The arguments in favor of using them for reduction until depletion can be shown, won out with the legislature but they did not win out with the Governor.

The most interesting contest over fisheries legislation was that which arose over the bill of Senator Sample of San Diego which prohibited the use of purse seines for barracuda, mackerel or any small fish, for it did not permit a purse seine to be used with meshes measuring less than four inches. The bill also prohibited the catching of barracuda with lampara or round-haul nets. The bill was introduced at the request of the organization of fishermen of San Diego who are principally gill-net fishermen and who are opposed most strongly by the purse seine and lampara fishermen and by the wholesale fish dealers of San Pedro.

The Fish and Game Commission knowing of the growing opposition to the nets which have been recently introduced and which have interfered economically with the gill net fishermen, employed Tage Skogsberg, a competent investigator, then on its staff, to make as thorough an investigation as was possible during the season prior to the meeting of the legislature. His conclusion was that there were no data to show that the use of purse and round-haul nets was depleting the barracuda as claimed. (See CALIFORNIA FISH AND GAME, July, 1923, p. 87.)

If it was a question of conserving the barracuda a short closed season during the time they were schooling in April and May, preparatory to spawning, would be sufficient. The fresh fish markets he found were dependent on these nets for their winter supply of fish and he recommended that no radical legislation be passed, such as limiting the size of mesh of the purse seine, for that would result in putting purse seiners out of business. He recommended that an investigation be undertaken on the barracuda similar to those being carried out on the albacore and sardine, in order that depletion may be detected in time to prevent serious results. Mr. Skogsberg's report was the only real evidence presented in the discussion, but it was not sufficient to prevent the passage of the bill. It was sufficient, however, to convince the Governor and the bill was not signed.

THE LAMPARA NET.

Whenever a new and improved type of fishing gear is introduced and it upsets the old economic order, there is immediate opposition. This opposition almost always has used the argument that the new type of net is destructive to young fish and to the spawn of the fish, or that it wastes the mature fish by making catches which glut the market and waste results on that account. The introduction of beam trawling in the North Sea and later the larger otter trawl brought on a bitter fight against their use by the inshore fishermen and lasted for many years. The disputes were the subject of several investigations by different boards appointed in England and Scotland and in some of the other countries bordering the North Sea.

At first, restrictive legislation was adopted which, in the light of later information it was deemed best to remove or modify. In our own state the first use of paranzella nets or trawls by steam tugs outside of San Francisco harbor brought forth protests from the other fishermen. The introduction of the lampara net in the sardine fishery at Monterey met with the same kind of opposition and at the 1913 session of our legislature was near to being outlawed. Yet it would be hard to devise a net which would cause less undue destruction of fish. If the legislation had been passed by the legislature of 1913 it would have been a serious blow to the future of the sardine industry for the present huge proportions of our sardine industry has been made possible largely by the introduction of the lampara net.

PROTECTION OF SALMON ESSENTIAL.

We have had a great many complaints about the salmon season closing too early at this place and that place, that fishermen were no longer able to make a living fishing for salmon and that there should be a longer open season at various places in California.

Permit us at this time to say to the fisherman, that we truthfully feel sorry for him. For the following shows the writing on the wall. The catch of salmon in California in 1919 was 13,145,728 pounds; 1920 was 11,133,819 pounds; 1921 was 7,990,932 pounds, and 1922 was 7,235,124 pounds. The catch for 1923 has not been completed but we are sure it will be far less than that of 1922.

Something had to be done in order that salmon would not become extinct. Power dams being constructed on rivers frequented by salmon, intense fishing for salmon in ocean waters, as well as in the rivers, made it necessary to shorten the time that salmon could be caught commercially.

The catch at Monterey Bay, including Santa Cruz, was almost a complete failure this year, although the catch in the ocean waters outside of San Francisco was fair, it will not come up to the catch of 1922.

At Noyo, near Fort Bragg, which is a very busy salmon fishing center, it was necessary for the plants at this point to close down much earlier this year than in former years, due to a very bad entrance to Noyo River and also due to a scarcity of fish. These plants closed the latter part of July, while in former years they ran during the month of September.

At Shelter Cove there was a good run of large fish the middle of July and this run continued until the close of the season, August 15th.

Off Eureka there was a good run of salmon until the latter part of July, after this date fairly good catches of salmon were made off Trinidad. These fish were picked up by buyer boats from the various fish companies and taken to Eureka.

On the Klamath River, at Requa, the run of salmon was very late and during the latter part of July and the first part of August, practically no fish were caught. The catch for the season will be far less than that of 1922.—E. D.

THE SARDINE SEASON AT MONTEREY.

The sardine canning season this year at Monterey started in May, a month earlier

than usual and promises to surpass any season since the war. Following the war there was a decided slump (1921) in the amount of sardines taken with a partial recovery in 1922 and the 1923 figures will probably show a complete recovery and the business running again on a normal basis. Sardine fishing at Monterey is conducted during ten months of the year, April and May being the off months. The figures published by the Fish and Game Commission show the catch summarized by calendar years and the cannery operators figure their seasons from January 1, to December 31, but as the canneries are closed down during part of the spring months it is, in some ways, more logical to figure the total catch by fishing seasons rather than calendar years. In the following table the total sardine catch of Monterey County is shown by fishing seasons, that is from May 1, of one year, to April 30, of the following calendar year. For simplicity, the figures have been rounded off to the nearest million pounds:

1916-1917 -----	15,000,000 lbs.
1917-1918 -----	46,000,000 lbs.
1918-1919 -----	72,000,000 lbs.
1919-1920 -----	86,000,000 lbs.
1920-1921 -----	50,000,000 lbs.
1921-1922 -----	33,000,000 lbs.
1922-1923 -----	58,000,000 lbs.

These figures show the rapid increase in catch during the war, with the drop in 1920-21. The financial slump hit the cannery business a little later than in most other industries over the country as a whole and is reflected in the small take of 1921-22. Last fishing season (1922-23) shows an upward trend. This present season has started with most encouraging prospects as the demand for our coast sardines seems to be much stronger than during the past three seasons.

At present, seven of the Monterey packing plants are operating and employing about 25 fishing crews. The K. Hovden Company has purchased the nearby plant, formerly known as the Great Western, and will operate it as the K. Hovden Plant No. 2. The Carmel Canning Company has made extensive improvements, including a new building that nearly doubles their floor space and the addition of a reduction plant for offal. One innovation at this plant is interesting all plant managers who have had trouble with seaweed and debris clogging the intake pipes of their water supply. A well was sunk in the rock under the cannery with a horizontal drift just under the water of the bay. The roof of the drift was then shot out so that loose rock filled in, thus allowing an abundant supply of

seawater to flow in after straining through the broken rock. The results are highly satisfactory.—W. L. S.

SARDINE FISHERMEN'S STRIKE AT MONTEREY, AND SETTLEMENT.

The sardine fishermen at Monterey were on a strike from September 17th to 24th. During this time 250 fishermen and several hundred cannery helpers were tied up. The main reason for the strike was dissatisfaction on the part of fishermen as to the two different prices paid for the sardines, those used for canning, and sardines used for reduction purposes. The fishermen felt that they did not always get paid for the full amount of fish delivered and that they had no way of checking whether the fish were used for reduction purposes, or for canning.

The question of weights was settled by calling in the State and County Sealer of Weights and Measures. As a result the canners were ordered to install uniform measuring buckets, and the round metal bucket, such as the one used by the K. Hovden plant, was agreed upon as the standard. All plants operating at Monterey have installed this uniform measure.

At first there was a deadlock in the negotiations on the question of a uniform price of \$10 per ton for the fish. Representatives of both sides of the controversy were induced to meet with representatives of the Monterey Chamber of Commerce, and finally reached an agreement on the following basis:

Price to be \$10 per ton for all sardines. No crew to fish for a limit of less than ten tons.

The crews fishing at present are considered sufficient for the plants now operating, no new crews to be taken on.

Number of crews per plant to be determined by plant capacity and a twelve-ton limit per boat.

Payment for fish delivered over the limit (when a limit is set) to go to the Fishermen's organization, and not to the individual fishermen.

No donations of fish to the canner allowed.

The crew to be fined \$500 for each donation proven.

Canner to deal only with the Fishermen's organization and not with individual crew captains.

Canner to order before 4 o'clock p.m. from the Fishermen's organization the lump tonnage he desires the following day.

The Fishermen's organization sets individual boat limits and the number of crews (if necessary) to comply with the canner's order for that day.

All deliveries to be measured in the standard metal bucket.

Crew captains (possibly the individual fishermen) will be paid by the organization and not by the canner, on the basis of tonnage shown by the official receipts

of the State Fish and Game Commission. The canner pays for the fish received in a lump sum to the Fishermen's organization twice a month.

Disputes in future to be submitted to arbitration before a strike is called. An arbitration board to consist of three: A representative of the fishermen, and a representative of the packers, these two to choose a third, an outsider.

When a crew is set a definite limit by its organization and delivers an excess, the payment for that excess goes into the treasury of the organization and the crew receives nothing for it. Also, during periods of so-called scarcity of fish, the canner need not order a definite tonnage, but may order a total catch of the usual number of crews fishing for his plant. This is just as in the past, when limits were removed during scarcity.

If this agreement holds, it will settle several of the difficulties of the Fish and Game Commission's administration. Most important of all, it will insure the delivered tonnage of fish being recorded on the official receipts issued by the canner to the fishermen, also, minor questions will be easier to handle, such as overcatches and the dumping of fish. Although these matters have been agreed upon by both sides in the controversy, it appears to be difficult for some of the canners to adjust themselves to the revolutionary idea of dealing with the Fishermen's organization, rather than with the separate crew of captains.—W. L. S.

HALIBUT IN CALIFORNIA.

Fishing boats working out of Eureka, California, this year have made some fairly good catches of "Northern" halibut, sufficient to stock the San Francisco market. The halibut is supposed to be scarce on the coast of California, although the large flounder known locally as "California" halibut is plentiful, especially in the southern part of the state.

The Western California Fish Company of San Francisco equipped several boats to fish for halibut off the Eureka coast, as an experiment, with the result that good catches were made. The halibut caught were fine big fish, in excellent condition, and with properly equipped boats, we feel confident good catches will continue to be made.—E. D.

WATER POLLUTION.

The State of California, through the Fish and Game Commission, has done a great deal to prevent the pollution of our waters with oil, mill and factory waste. It even has succeeded in getting some good laws on the statute books, but a great deal of work remains to be done.

Due to the great development of the oil industry in this state, our greatest problem is in the matter of oil pollution. The oil is piped from the oil fields to our harbors, where it is stored, refined and loaded on ships for fuel and transportation.

At the present time the Fish and Game Commission has the cooperation of the various oil companies, shipyards, steamship companies and railroads in preventing oil from getting into our waters. With all this the oil frequently gets away, through accident or carelessness and causes great damage to harbors, loss to bathing beaches, pleasure boats and other water craft. The piling around the various piers become covered with oil which adds greatly to the fire hazards. Recently it became necessary for the San Francisco Harbor Commission to post signs on all wharves along the water front, prohibiting smoking. This was due to the fact that the pilings were saturated with oil and to prevent disastrous fires, these measures were taken.

The principal concern of the Fish and Game Commission is the damage and destruction to bird and fish life. The feathers of the various kinds of waterfowl become saturated with oil, so that they can not fly and sooner or later die. The loss of water birds, such as wild ducks, from this cause is at times very serious.

Young clams on the beaches and mud flats are killed by coming in contact with the oil. The fish are damaged indirectly by lack of food, caused by the oil killing the diatoms and other plankton which form the basis of the food supply for our fish. It may be that oil pollution is a more serious menace to the fish of our inland waters than overfishing.

Some of the worst offenders are ships that come into our harbors, which after unloading their cargoes, and before taking on a new supply of fuel oil, pump the ship's bilges into the bay. Shipyards that repair tankers, or oil carrying barges, are sometimes careless in taking care of oil that comes from these ships, also garages that empty their greases into the public sewers, which in many instances empty into rivers or bays.

To stop all pollution of our waters, this Commission invites the cooperation of all civic organizations, the assistance and cooperation of all manufacturing plants, oil companies, shipyards, steamship companies, railroads, garages and gas companies, and we are sure that with the help of these organizations, it will be possible to keep the waters of California clean.—E. D.

CONSERVATION IN OTHER STATES.

NEW GAME PRESERVES FOR LOUISIANA.

Edward Avery McIlhenny, donor to the State of Louisiana of the Rockefeller-Sage and Rainey-McIlhenny game preserves has recently acquired additional land which, added to what he already owned, will give him control of a total of 100,000 acres of land in the game regions along the gulf coast. Mr. McIlhenny announces that game will be protected on this area, which means that wild life will now be safeguarded on all of the territory from the mouth of the Mississippi to Texas along the Gulf coast line for a distance of 75 miles and an area of 700 square miles inland. For several years Mr. McIlhenny has been following a broad and far-sighted policy of game conservation. This 100,000 acres, though very fertile land is not being developed for agricultural purposes. Instead, an interlacing system of ponds, canals and lakes is being laid out and the whole region planted with the food plants of wild game birds. This provides permanent feeding grounds on protected areas for the millions of waterfowl and other game birds which annually migrate to this region. Many game animals and fur-bearers also frequent these feeding grounds and a force of wardens is employed by Mr. McIlhenny to see that the game laws are followed. Who will do as much for California?

HUNTING ACCIDENTS REDUCED IN WYOMING.

Game laws in Wyoming now require every hunter to wear some distinguishing mark on his hat. The last Biennial Report of the Wyoming Fish and Game Commission reports that no accidents occurred during the 1921 open season and this is attributed to this new law.

COMMON SENSE.

"The man who violates the fish and game laws is cheating you. Help us to educate him, or to punish him if he is a wilful offender."—New Jersey Fish and Game Commission.

DEPREDACTIONS OF DEER IN NEW JERSEY NEGLIGIBLE.

New Jersey allows the killing of deer trespassing upon cultivated lands. The person killing a deer because of depredations must report to the Fish and Game Commission within 48 hours. The fact that but two deer were so killed and reported makes it evident that depredations by these animals have been greatly exag-

gerated. Every state which has provided for remuneration for the damage of crops has proved the same thing.

NEW JERSEY TO INTRODUCE RABBITS.

New Jersey is now planning the introduction of snowshoe rabbits. However, inability to secure a supply from other states is causing some delay in carrying out the plan.

MINNESOTA REPORTS DEER DEPLETION.

The 1922 Biennial Report of the Minnesota Fish and Game Commission records a kill of 18,000 deer annually. Minnesota is one of the only states in the Union that still allows the killing of does and fawns and it is estimated that half of the total kill is made up of animals of these categories. The Commissioner reports a steady depletion in the deer as a result of extensive hunting and the destruction of does and fawns.

Apparently it is almost impossible for one state to profit by the experience of another. It must experience evident depletion itself before taking measures to conserve a supply. The trouble is, quite often these measures come altogether too late to give satisfactory results.

Minnesota now boasts of 69 game refuges. Many of them, however, are of small size.

Fur farming is to be a considerable industry in Minnesota for the breeding stock of the various game farms is valued at \$657,390. There are 1600 foxes and 375 skunks used as breeding stock on the various fur farms.

VERMONT NOW HAS BUCK LAW.

The Biennial Report of the Vermont Fish and Game Commission reports a reduction in the deer kill from 4477 in 1920, to 1507 in 1921, with the inauguration of the buck law. Doubling of the season from 6 days to 12 days gave only about one-third the normal kill when both does and bucks were allowed to be killed.

NEW MEXICO PROVIDES RESTING AREAS FOR WATERFOWL.

New Mexico has provided nine resting areas for ducks on the Rio Grande River. Certain areas located below some of the more prominent bridges across the river are designated as resting areas and the penalty for shooting on these areas is set at a fine not exceeding \$300 and imprisonment not exceeding 30 days.

FAVORITE LAKE FOR BIRDS SAVED TO MINNESOTA.

Swan Lake, a valuable and unusual body of water about 10,500 acres in area, located in Nicollet County, Minn., has been saved to the state through the efforts of the State Game and Fish Commissioners, the Biological Survey of the United States Department of Agriculture and landowners and local conservationists of the region. A movement to lower the level of the lake four feet, eventually draining it entirely, was successfully opposed and defeated at two hearings after an examination of the wild fowl and food plant value of the lake had been made by three representatives of the Biological Survey.

In deciding this case the District Court in Minnesota laid emphasis on the great importance to the public welfare of such bodies of water as Swan Lake. Its favorable location, its relatively shallow fresh water, and its abundant growth of vegetation suitable for cover, nesting sites, and food have made it an attractive resort for many kinds of waterfowl. Its margins and wooded islands are a valuable asset in the conservation not only of game birds but also of insectivorous birds useful to farmers. Among the water birds that breed on the lake are several species of ducks, including mallards, blue-winged teal, redheads, lesser scaup, and ruddy ducks; sora rails, Florida gallinules, American coots, four species of grebes, black terns, and black-crowned night-herons are also common.

At least 50 kinds of plants valuable as food for water birds grow in this lake, including practically all the best duck food plants of the United States. There is also an abundance of fresh-water snails of several species liked by water birds. Lowering the level of this lake materially would eventually cause the disappearance of its present kind of vegetation and gradually destroy its value as a waterfowl resort.

WEST VIRGINIA ESTABLISHES REFUGES.

West Virginia is one of the later states to join the conservation movement, its Game and Fish Commission having been created in 1921 and its fish and game code enacted by the legislature of that same year. It is, however, pursuing an intelligent and vigorous policy of protecting and building up its many resources of forest and stream and it appears that these efforts are meeting with satisfactory response. Appreciation of the value of game preserves is evidenced in the

statement of the Chief Game Protector, Mr. A. B. Brooks, in the July bulletin of the American Game Protective Association. "The West Virginia law authorizes the purchase and protection of lands for park and game preserve purposes; but since the total revenue for forest, fish and game work is derived from hunting and fishing license fees, the funds necessary for these purposes are not yet available. To avoid waste of time, however, the commission is establishing game refuges on privately owned lands. Seven such refuges have been set aside, having a combined area of about 22,000 acres. This number will be increased as rapidly as possible."

INCREASED LICENSE FEES.

During the past year, increased license fees were provided for in Pennsylvania, Tennessee, Utah, Manitoba, Northwest Territories, and New Brunswick. Evidently Canada is just as progressive as the United States. If sportsmen continue their demands for more and more fish and for better patrol service, increased funds will be necessary. There has been increasing sentiment favoring a higher license fee for the angler. Proposed legislation looking in this direction failed to receive favorable action at the last legislature.

NEVADA ESTABLISHES GAME REFUGES.

A new Nevada law authorizes the governor to select and set aside areas of the public domain, not exceeding 25 in number, as recreation grounds and game refuges. On June 30th a proclamation was issued setting aside recreation grounds and game refuges as follows: Jarbidge, approximately 40,300 acres, and Humboldt, approximately 206,800 acres, in Elko County; Santa Rosa, approximately 64,000 acres, in Humboldt County; Grant, approximately 377,500 acres, and Reese River, approximately 198,500 acres, in Nye County, and an addition to the Grant refuge, approximately 25,600 acres, in Lincoln County; Lehman, approximately 175,512 acres, and Schell Creek, approximately 70,400 acres, in White County; an antelope preserve in Washoe County, comprising that portion of the public domain north of township 33 north; a sanctuary for quail and pheasants, extending from the north bank of the Truckee River to a line parallel with it and one mile uniformly distant, limited on the west by the Glendale bridge and on the east by the Derby dam; a refuge in Clark County, comprising that portion of the

public domain lying between the south line of township 16 south and the north line of township 22 south, ranges 55 to 58 east, comprising approximately 403,200 acres; and a refuge in Lander County, located on Birch, Kingston, Washington, and Big Creeks.—U. S. Dept. Agric. Farmers' Bull., No. 1375.

MICHIGAN HITS SHOOTING MONOPOLY.

To prevent the monopolizing of shooting rights, Michigan has enacted a law which restricts the size of private preserves of hunting grounds to not more than 15,000 acres in one tract, and prohibits the

establishment of a new preserve within two miles of one already in existence.

FRANCE ENTERTAINS PROTECTIONISTS.

France, as represented by the Societe d'Acclimatation de France and the Litue pour la Protection des Oiseaux, held an International Conference on the Protection of Nature, "Sites et Monuments Naturels," during June, 1923. M. Delacour, President of the Ligue, presided over the section dealing with fauna. Reserves, public parks and gardens, as well as wild life conservation were subjects for discussion.

REPORTS.

STATEMENT OF INCOME.

For the Period July 1, 1922, to June 30, 1923, of the Seventy-fourth Fiscal Year.

License Sales:	Detail	Total
Angling	\$217,077 00	
Hunting	249,521 00	
Market fishermen's	46,510 00	
Wholesale fish packers'	1,170 00	
Trapping	3,119 00	
Game breeders'	152 50	
Fish breeders'	40 00	
Fish importers'	5 00	
Kelp	10 00	
Total license sales		\$517,604 50
Other Income:		
Court fines	\$30,803 00	
Fish tag sales	3,111 09	
Fish packers' tax	38,033 44	
Game tag sales	7 01	
Sale of nets	140 00	
Sale of launch	60 00	
Sale of typewriter	22 50	
Crawfish inspection	210 00	
Total other income		72,387 04
Total income		\$589,991 54

STATEMENT OF INCOME.

For the Period April 1, 1923, to June 30, 1923, of the Seventy-fourth Fiscal Year.

License Sales:	Detail	Total
Angling	\$78,317 00	
Hunting	32,954 00	
Market fishermen's	17,830 00	
Wholesale fish packers'	90 00	
Trapping	321 00	
Game breeders'	87 50	
Fish breeders'	5 00	
Total license sales		\$129,604 50
Other Income:		
Court fines	\$7,653 00	
Fish tag sales	326 10	
Fish packers' tax	28,711 84	
Sales of nets	140 00	
Sale of launch	60 00	
Sale of typewriter	22 50	
Crawfish inspection	210 00	
Total other income		\$37,123 44
Total income		\$166,727 94

STATEMENT OF EXPENDITURES.

For the Period July 1, 1922, to June 30, 1923, of the Seventy-fourth Fiscal Year.

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration:					
Commissioners			\$546 35		\$546 35
Executive offices	\$346 32	\$16,173 20	5,737 46	\$903 78	23,160 76
Printing			4,149 13		4,149 13
Research and publicity	226 71	4,339 27	695 28	370 00	5,631 26
Accident and death claims			2,702 43		2,702 43
Department totals	\$573 03	\$20,512 47	\$13,830 65	\$1,273 78	\$36,189 93
Commercial fishculture and conserva- tion:					
Superintendence	\$137 24	\$10,391 58	\$5,398 05	\$219 37	\$16,136 24
Inspection and patrol	4,694 25	21,798 19	6,756 84	194 74	33,444 02
Research	200 65	17,204 28	2,166 35	314 13	19,885 41
Statistics	676 02	4,698 87	158 51	5 25	5,538 65
Market fishing license commissions			482 00		482 00
Propagation and distribution of salmon	6,674 27	14,033 92	988 80	594 50	22,291 49
Department totals	\$12,882 43	\$68,116 84	\$15,950 55	\$1,327 99	\$97,777 81
Sporting fishculture and conservation:					
Superintendence	\$362 62	\$10,286 31	\$29,828 78	\$6 25	\$40,483 96
General patrol (40 per cent)	1,067 36	48,185 27	31,123 46	268 93	80,648 02
Propagation and distribution of trout	26,730 12	61,740 16	23,498 76	5,988 80	117,907 84
Department totals	\$28,160 10	\$120,211 74	\$84,454 00	\$6,213 98	\$239,039 82
Game conservation:					
Superintendence		\$1,528 06	\$36,564 91		\$38,092 97
General patrol (60 per cent)	\$1,601 04	72,277 90	46,689 69	\$403 39	120,972 02
Department totals	\$1,601 04	\$73,805 96	\$83,254 60	\$403 39	\$159,064 99
Tahoe camping ground	\$120 82	\$659 25	\$19 08		\$799 15
Grand totals	\$42,837 42	\$283,306 26	\$197,508 88	\$9,219 14	\$532,871 70

STATEMENT OF EXPENDITURES.

For the Period April 1, 1923, to June 30, 1923, of the Seventy-fourth Fiscal Year.

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration:					
Commissioners			\$147 52		\$147 52
Executive offices	\$221 39	\$4,170 66	1,422 74	\$637 73	6,502 62
Printing			845 04		845 04
Research and publicity	—95	1,050 00	1 20		1,050 25
Accident and death claims			752 77		752 77
Department totals	\$220 44	\$5,220 66	\$3,160 27	\$637 73	\$9,298 10
Commercial fishculture and conserva- tion:					
Superintendence	\$63 41	\$2,665 00	\$1,873 75	\$168 32	\$4,770 48
Inspection and patrol	2,193 59	5,635 00	2,144 16	72 90	10,045 65
Research	38 10	3,961 73	206 57	110 70	4,317 10
Statistics	674 94	1,110 00	74 19	5 25	1,864 38
Market fishing license commissions			156 00		156 00
Propagation and distribution of salmon	2,508 35	2,426 32	180 28	518 83	5,633 78
Department totals	\$5,478 39	\$15,708 05	\$4,634 95	\$876 00	\$26,787 39
Sporting fishculture and conservation:					
Superintendence	\$72 19	\$2,440 50	\$9,254 14		\$11,766 83
General patrol (40 per cent)	502 77	12,074 07	7,926 64	\$253 25	20,756 73
Propagation and distribution of trout	9,917 86	18,786 21	3,652 45	5,702 29	38,058 81
Department totals	\$10,492 82	\$33,300 78	\$20,833 23	\$5,955 54	\$70,582 37
Game conservation:					
Superintendence		\$300 00	\$11,418 98		\$11,718 98
General patrol (60 per cent)	\$754 14	18,111 09	11,889 97	\$379 87	\$31,135 07
Department totals	\$754 14	\$18,411 09	\$23,308 95	\$379 87	\$42,854 05
Tahoe camping ground	\$112 22	\$195 00	\$16 83		\$324 05
Grand totals	\$17,058 01	\$72,925 58	\$51,963 23	\$7,899 14	\$149,845 96

[illegible]

All amounts shown in pounds. Albacore cleaned.

12,679 doz. 2 doz. 33 doz. 354,200 shell oysters. 3 doz. 4,083 doz. 248,750 shell oysters. 138 doz. 1017 doz.

VIOLATIONS OF FISH AND GAME LAWS, FISCAL YEAR 1922-1923.

HUNTING.	1922		1923	
	July-Sept.	Oct.-Dec.	Jan.-April	March-June
Without hunting license	25	30	16	5
License, failure to show	1	5		
Quail, closed season	15	13	1	
Quail, sale of				1
Quail, trapping of		1		
Wild pigeons, closed season	1	9	9	2
Grouse, closed season	1			1
Sage-hens, closed season	2			1
Pheasants, closed season	2		2	
Ducks, closed season	17		22	4
Ducks, over limit		6		
Mud hens, closed season	1			
Geese, closed season			1	2
Geese, over limit		3		
Shore birds, closed season		19	2	
Doves, closed season	21			2
Non-game birds	2	18	10	5
Rabbits	10	3	2	4
Squirrels			1	
Deer, closed season	19	15	26	8
Deer, killing of does and fawns	5	8	5	1
Deer, over limit		1		
Deer, dogs, closed season		2		1
Deer, illegal heads or hides	5	9		
Mountain sheep				1
Shooting from auto	2	1		
Shooting from power boat		5		
Hunting in game refuge	3	2	3	6
Nighting hunting	1	27	6	
Trespassing		16		1
Totals	165	201	108	45
FISHING.				
Without angling license	10	6	15	40
Trout, closed season		1	31	33
Trout, over limit	5	5	4	24
Trout, illegally taken	10	2	2	5
Salmon, over limit		1	1	
Salmon, illegal sale		1		
Salmon, illegal spearing	2			
Black bass, closed season			2	7
Black bass, under size	3			6
Black bass, buy or sell	2			
Striped bass, over limit	5	1		2
Striped bass, under size	5	1		21
Striped bass, over size				1
Striped bass, illegal sale	2	1	1	
Crappie, closed season			1	
Sunfish, closed season				1
Perch, closed season				1
Perch, sale			1	
Catfish, sale of undersized			2	
Barracuda, undersize	2			8
Halibut, undersize		3		
Sturgeon, closed season	2			
Abalones, closed season			6	
Abalones, undersize	2	5	1	25
Abalones, over limit	1	4		9
Abalones, illegal shipment			1	
Abalones, drying	1			
Abalones, brought ashore dead		1		
Clams, closed season				1
Clams, over limit	2	7	12	6
Clams, undersize	7	26	28	8
Clams, illegal shipment			1	
Crabs, undersize		3	6	7

VIOLATIONS OF FISH AND GAME LAWS, FISCAL YEAR 1922-1923—Cont'd.

FISHING—Continued.	1922		1923	
	July-Sept.	Oct.-Dec.	Jan.-April	March-June
Crabs, illegal shipment.....			2	2
Lobsters, closed season.....	2		1	3
Lobsters, undersize.....		18	2	
Lobsters, oversize.....		3		
Within 250 feet of fishway.....		2	4	7
Taking from spawning station.....				2
Killing fish with dynamite.....	1		1	
Obstruction in stream.....				1
Night fishing.....	3			5
Without commercial license.....	43	2	2	
Destroy food fish.....			1	
Illegal use nets, traps, lines, etc.....	16	7	5	16
Commercial fishery data; failure to keep.....			1	
Ship fish by parcel post.....	1			
Water pollution.....			2	
Totals.....	128	100	137	250

CASES.

Recapitulation (as of December 1, 1923). July 1, 1922, to June 30, 1923.

	July, Aug., Sept.	Oct., Nov., Dec.	Jan., Feb., March	April, May, June	Total for year
Convictions.....	228	227	198	232	885
Bail forfeited.....	19	30	2	19	70
Sentence suspended.....	28	33	21	31	113
Pending.....	9	2	3	3	17
Dismissal-acquittal.....	7	4	9	6	26
Juvenile.....	2	5	12	4	23
Total arrests by quarters.....	293	301	245	295	
Total arrests for year.....					1,134

ARRESTS, FISCAL YEAR, JULY 1, 1922-JUNE 30, 1923.

Nationality	1922		1923		Totals
	July-Sept.	Oct.-Dec.	Jan.-March	April-June	
Citizen	133	138	143	155	569
Armenia	1				1
Austria	20	3	4	4	31
Canada				1	1
China	2		4		6
England	1			2	3
France	1	5	1	13	20
Greece	4	6	2	2	14
Germany			2	5	7
Guatemala	1				1
Ireland	1	2		1	4
Italy	33	38	28	23	122
Japan	13	10	13	20	56
Mexico	4	2	2	1	9
Norway		2		1	3
Portugal	6	15	5	6	42
Russia	2	2			4
Scotland				1	1
South Wales			1		1
Spain		1		3	4
Sicily		2			2
Serbia	1	1			2
Sweden	3	2		2	7
Switzerland	1		2		3
Not given	66	72	37	55	230
Totals	293	301	245	295	1,133

SEIZURES, FISCAL YEAR, 1922-1923.

	1922		1923	
	July-Sept.	Oct.-Dec.	Jan.-March	April-June
Ducks	284	2,478	706	8
Geese		51	10	4
Shore birds		27	12	
Quail	11	53	14	
Grouse	1			2
Sage-hens	27			
Wild pigeons		9	5	1
Doves	79			
Pheasants			3	
Non-game birds		7	31	
Deer meat (pounds)	543	259	412½	77
Deer hides	2	1	2	
Mountain sheep heads				2
Rabbits	21	4		1
Trout	108	33	9	657
Trout (pounds)		574½	235½	743½
Salmon (pounds)	1,151	834	927	89½
Catfish (pounds)			177	
Black bass	44			102
Striped bass	183			103
Striped bass (pounds)	964	544½	173	342
Barracuda (pounds)	875	600		11,431
Halibut (pounds)		1,030		
Sturgeon (pounds)	254			
Whitebait (pounds)				40
Crapple				8
Sunfish				44
Hardhead				31
Crab	2,188	1,873	271	671
Crab meat (pounds)		10		35
Lobster	70	145	25	
Lobster (pounds)	100	1,536		507
Lobster	1 box		15 boxes	10 sacks
Abalone	117	125	162	308
Clam	240	1,075	271	845
Clam (pounds)			40	
Mussel	260			
Shrimp (pounds)			10	
Shrimp meat (pounds)				160

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